2 ALTERNATIVES

This chapter describes the system-wide intercity transportation alternatives and the alignment options for the proposed high-speed train (HST) system considered in this tier 1/program-level environmental document. Because this is a program-level analysis considering the entire HST system and is intended to define broad differences between alternatives, the level of detail for alternatives is conceptual or general rather than project-specific (40 C.F.R. § 1508.28; 14 C.C.R. § 15385). Subsequent project-specific environmental documents and analysis would assess preliminary engineering information and provide more details on environmental impacts for alternatives carried forward.

The alternatives and design options discussed in this chapter are based on previous feasibility studies defining the project, the scoping process, and the HST alignment and station screening evaluation process. All alternatives that have been considered are described in this chapter, including those rejected from further consideration in this Program Environmental Impact Report/Environmental Impact Statement (Program EIR/EIS) and the basis for their rejection. The system alternatives—the No Project/No Action, Modal, and HST Alternatives—are described in detail in this chapter, and their development is summarized.

The following sections provide a brief synopsis of the system alternatives analyzed by the California High Speed Rail Authority (Authority) and the Federal Railroad Administration (FRA) in this Program EIR/EIS. In addition to the No Project/No Action Alternative, required by CEQA and NEPA, and the HST Alternative, the Authority and the FRA developed the Modal Alternative, which represents a potentially feasible alternative to the proposed HST system.

2.1 SUMMARY OF SYSTEM ALTERNATIVES

2.1.1 No Project Alternative

The No Project/No Action (No Project) Alternative represents the state's transportation system (highway, air, and conventional rail) as it is today and would be after implementation of programs or projects that are currently in regional transportation plans and have identified funds for implementation by 2020.

2.1.2 Modal Alternative

During the screening evaluation process, the Authority and the FRA developed several conceptual modal alternatives that focused on potential improvement to existing modes of intercity travel. Under these alternatives, the proposed HST system would not be implemented, and the existing transportation infrastructure would be expanded to accommodate the anticipated future intercity travel demand in the same geographic markets as the HST Alternative. The Modal Alternative analyzed in this Program EIR/EIS includes a combination of potentially feasible highway and aviation system improvements that focus on quantifiable capacity enhancements, primarily additional through lanes, passenger terminal gates, runways, and associated improvements. Existing conventional passenger rail was not included in this alternative because it would not meet the same intercity demand that would be served by the proposed HST system.

2.1.3 High-Speed Train Alternative

The Authority and the FRA developed a range of potential HST corridors, and alignment and station options within the corridors. Informed by previous studies and the scoping process, the Authority and the FRA evaluated the potential HST corridors and identified those that best met the project purpose and need. Through the screening process, reasonable and feasible alignment and station options were identified. The proposed HST corridors and study regions used for all alternatives are shown in Figure 2.1-1.

Several train technologies and systems were also considered at the screening level. The HST train technology analyzed in this Program EIR/EIS is electrified steel-wheel-on-steel-rail dedicated service, with a maximum speed of 220 mph or 350 kph. The HST system would use electrically powered trains capable of maximum operating speeds of 220 mph [350 kph] using steel-wheel-on-steel-rail technology. A fully grade-separated, access-controlled right-of-way would be constructed, except where the system would be able to share tracks at lower speeds with other compatible passenger rail services. Shared-track operations would use existing rail infrastructure in areas where construction of new separate HST facilities would not be feasible. While shared service would reduce the flexibility and capacity of HST service because of the need to coordinate schedules, it would also result in fewer environmental impacts and a lower construction cost.

2.2 CHAPTER ORGANIZATION

The remainder of this chapter is organized into the following five sections.

- Section 2.3 describes the development of the alternatives.
- Section 2.4 describes the No Project Alternative.
- Section 2.5 describes the modal options considered and rejected, as well as the Modal Alternative carried forward for further consideration in this Program EIR/EIS.
- Section 2.6 describes the HST Alternative, including the technology, system-performance criteria, alignment, and station options considered and rejected, as well as those carried forward for further consideration in this Program EIR/EIS.
- Section 2.7 summarizes the alternatives analyzed in this Program EIR/EIS.

2.3 DEVELOPMENT OF ALTERNATIVES

This section describes the process used to evaluate conceptual alternatives presented in previous feasibility studies and identified through the scoping and screening process for a proposed California HST system, leading to the set of system alternatives and HST alignment options that are analyzed in this Program EIR/EIS. Key criteria used to distinguish among alternatives are described in Chapter 1 (*Purpose and Need and Objectives)*. Those criteria include connectivity, right-of-way constraints and compatibility, ridership potential, constructability, and environmental impacts.

2.3.1 Background

Since 1994, three planning and feasibility studies have been completed under the direction of the California Department of Transportation (Caltrans), the former California Intercity High Speed Rail Commission (Commission), and the current Authority. The specific scopes of work of the studies differed, but they all focused on identifying potential HST technologies and corridors and broadly evaluated their feasibility. These three studies culminated in the Authority's final business plan (Business Plan) for an economically viable HST system that would serve major metropolitan areas of California (California High Speed Rail Authority 2000).

These planning and feasibility studies considered environmental constraints and potential impacts, with the objective of avoiding or minimizing impacts on sensitive resources where possible. Most of the corridors considered follow existing highways or railroad lines, particularly in urban areas, to avoid or minimize environmental impacts. Many of the options for corridor and station locations emerged from regional and local agency input. Potential station locations were identified for operational and ridership forecasting purposes, and alternative sites were considered as part of the corridor evaluation. However, specific station sites were not selected. The studies were done consecutively, such that each subsequent study benefited from and built on previous work to further refine and develop potential HST options. The scope, timing, and products of each of the three studies and the Business Plan are described below. The relationship between the studies is illustrated in Figure 2.3-1.

A. LOS ANGELES TO BAKERSFIELD PRELIMINARY ENGINEERING FEASIBILITY STUDY (1994)

Completed by Caltrans in 1994, this study analyzed the feasibility of constructing an HST system across the Tehachapi Mountains in southern California. The Tehachapi Mountains comprise one of the largest physical constraints (if not the largest physical constraint) to the development of a statewide HST network. The study produced an evaluation of the various HST technologies as well as engineering drawings, cost estimates, and preliminary environmental analysis for potential alignments traversing the Tehachapi Mountains. The study also produced drawings and cost estimates for potential stations, developed operating plans, and estimated travel times for this segment of a statewide system. The study is documented in the *Los Angeles–Bakersfield Preliminary Engineering Feasibility Study Final Report* (California Department of Transportation 1994).

Alignments were studied using then-current aerial photographs and maps at a scale of 1 inch (in) equals 200 feet (ft). The feasibility study included preliminary engineering analysis of several key technical issues (e.g., structures, tunneling, and unit capital costs). The corridors studied traversed a variety of terrain (e.g., urban development, mountains, and valley floor). Work performed for the Los Angeles to Bakersfield study provided an important foundation for the subsequent statewide corridor evaluation studies.

The feasibility study considered a broad range of alternative alignments and then focused on the most viable routes. Two main corridors between Los Angeles and Bakersfield were considered feasible in terms of cost, travel time, potential ridership, and environmental constraints: Interstate 5 (I-5)/Grapevine and Palmdale-Mojave (Antelope Valley).

B. CORRIDOR EVALUATION AND ENVIRONMENTAL CONSTRAINTS ANALYSIS (1996)

This study was conducted by the Commission in three phases and was completed in 1996. The first phase defined the most promising corridor alignments for linking the San Francisco Bay Area and Los Angeles (Figure 2.3-2). During the second phase, these alternative corridors between Los Angeles and the Bay Area were examined in more detail. The third phase examined potential HST system extensions to Sacramento, San Bernardino/Riverside, Orange County, and San Diego.

The study identified potential station locations; estimated travel times; developed construction, operation, and maintenance cost estimates; analyzed environmental constraints and possible mitigation measures; and, in an iterative process with a ridership study prepared for the Commission, developed a conceptual operating plan. The corridors considered in all phases of this study are described in the *High-Speed Rail Corridor Evaluation and Environmental Constraints Analysis Final Report* (California Intercity High Speed Rail Commission 1996).

This analysis was completed concurrently with studies addressing four other aspects of a proposed high-speed rail system: ridership and revenue projections, institutional and financial options, economic impacts and benefit/cost analysis, and public participation. The corridors recommended for study by the 1996 analysis are shown in Figure 2.3-3.

C. HIGH-SPEED RAIL CORRIDOR EVALUATION (1999)

In September 1998, the Authority initiated a study to evaluate the viability of various corridors throughout the state for a statewide HST system. The Authority was legislatively mandated to move forward in a manner that was consistent with and continued the work of the Commission. Potential corridors were evaluated for capital, operating, and maintenance costs; travel times; and engineering, operational, and environmental constraints. This study is documented in the *California High-Speed Rail Corridor Evaluation Final Report* (California High Speed Rail Authority 1999).

This study provided the Authority with a basis for recommending a potentially feasible network of HST corridors for further study. While previous studies had been limited in the number of alternatives that could be analyzed in certain areas of the state, other potential corridors and new issues were identified in the 1999 study as regional and local agencies provided their input on the recommendations of the previous studies. Two corridor alternatives were not recommended for study as part of this evaluation: the Altamont Pass corridor and the Los Angeles-Orange County-San Diego (LOSSAN) corridor as a dedicated line.

D. BUSINESS PLAN

The Business Plan presents a reasoned approach for constructing, operating, and financing an efficient and economically viable statewide HST system capable of speeds up to 220 mph (350 kph) that would be electrically powered and fully grade-separated, and link California's major metropolitan areas. The Business Plan was based on the analysis from the *High-Speed Rail Corridor Evaluation* (1999) as well as ridership and revenue, cost-benefit, financial planning, and system integration studies.

The Business Plan concluded that "a high-speed train system is a smart investment in the state's future mobility. It will yield solid financial returns to the state and provide potentially dramatic transportation benefits to all Californians. It is a system that can be operated without public subsidy. The public's investment should be limited to that which is necessary to ensure the construction of the basic system."

The analysis and objectives summarized in the Business Plan found that an HST system would be able to:

- Return twice as much financial benefit to the state's citizens as it costs.
- Carry at least 32 million intercity passengers and another 10 million commuters annually.
- Generate about $900 million in revenues and return an operational surplus of more than $300 million per year.

The Authority recommended initiating a formal environmental review process with a system-wide program-level EIR/EIS on the HST network described in the Business Plan.

2.3.2 Formulation of Alternatives

With the initiation of the high-speed rail (HSR) program environmental review, the Authority and the FRA began the process of defining reasonable and feasible alternatives to be considered in this Program EIR/EIS. This effort involved the development of an HST Alternative (including design options) and other system alternatives focused on other intercity modes of transportation. The process involved consideration of the purpose and need for the proposed action and consultation with public agencies and the public, as described below.

A. AGENCY AND PUBLIC CONSULTATION AND SCOPING

Early steps to define the project and alternatives to be carried forward in this Program EIR/EIS involved consultation with public agencies and obtaining comment from the public. Sixteen public town hall meetings were held between February and April 2001, with professionally facilitated discussions to obtain public input. Information from these town hall meetings regarding HST alignments and station options was used in the preparation of scoping materials and presentations and incorporated into the screening evaluation.

Further agency and public input was obtained during the scoping process pursuant to CEQA and NEPA. The notice of preparation (NOP) was released April 6, 2001, and the notice of intent (NOI) was published in the Federal Register on May 2, 2001. Written comments were received in response to these notifications.

Scoping activities for this Program EIR/EIS were conducted during the scoping period between April 6, 2001, and May 31, 2001. Due to the geographical extent and complexity of the proposed project, many scoping meetings were held. A statewide agency and public scoping meeting was held on April 24, 2001, in Sacramento to obtain public and agency input. A series of nine additional scoping meetings followed throughout the state as well as other meetings, briefings, and involvement activities.

The Program EIR/EIS scoping process identified areas of potential concern related to the proposed HST system. Many comments indicated the need for an improved statewide transportation system that is reliable, cost effective, and easy to use. Many comments also emphasized the need for an HST system to connect to existing transportation systems, including airports. Providing for potential freight service was also a frequent theme. Issues of concern about the environment typically focused on potential noise and visual impacts, safety, and impacts on air quality and sensitive habitats. The potential for growth inducement was also raised. The scoping process and outcomes, including comments and concerns pertaining to each region, are documented in the *California High-Speed Train Statewide Scoping Report* (California High Speed Rail Authority 2002).

B. AGENCY INVOLVEMENT

Following the issuance of the NOI and NOP and the scoping meetings, the Authority and the FRA formed a working group of representatives from 27 federal and state agencies to assist in the environmental review process. The interagency group has met periodically during the Program EIS/EIR development to discuss major issues from the perspective of these agencies and to provide input to the lead agencies to help focus the analysis and streamline the review process.

The federal and state agency representatives included in this process were asked to provide input for the following specific areas.

- Scope of the Program EIR/EIS.
- Purpose and need statement.
- Technical methods of analysis and study area definition.
- Substantive issues of particular concern.
- Sources of information and data relevant to their agencies.
- Avoidance, minimization, and mitigation strategies.
- Decisions at major milestones in the environmental process.

- Screening and definition of alternatives to be analyzed in the Program EIR/EIS.
- Procedural requirements and permits or approvals necessary for subsequent phases of environmental review.

The Authority also invited input from regional and local agencies in areas potentially affected by the proposed HST system. Meetings of the Authority governing board have provided a forum for providing information about the environmental process. These meetings have been held in major cities in the project area to provide a convenient opportunity for regional and local participation and input.

As discussed in Section 1.1, the FRA is the lead federal agency for NEPA compliance, and federal cooperating agencies include the Federal Highway Administration (FHWA), Federal Transit Administration (FTA), Federal Aviation Administration (FAA), U.S. Army Corps of Engineers (USACE), U.S. Environmental Protection Agency (EPA), and the U.S. Fish and Wildlife Service (USFWS). The FRA developed a memorandum of understanding (MOU) with the federal cooperating agencies to clarify expectations for the preparation and review of the Program EIR/EIS and for Clean Water Act Section 404 review. The memorandum of understanding (MOU) is included as Appendix 1-A. The federal cooperating agencies have met during the environmental review process to provide input to the Program EIR/EIS, and their involvement is expected to continue throughout the program environmental process.

C. ALTERNATIVES DEVELOPMENT

In 1997, the FRA published *High-Speed Ground Transportation for America,* a national study examining the commercial feasibility of new high-speed ground transportation systems (Federal Railroad Administration 1997). This commercial feasibility study uniformly applied economic principles to weigh likely investment needs, operating performance, and social benefits of different types of train services in regional travel markets. The Authority followed these principles and in the Business Plan defined a practical approach to construct, operate, and finance an HST system that would yield solid financial returns to the state and provide potentially dramatic transportation benefits to all Californians. The development of the alternatives considered in this Program EIR/EIS incorporated the principles set forth in the Business Plan to minimize capital and operating costs while maximizing total benefits.

The FRA and the Authority recognize that the HST system would require a commitment of substantial resources, and that this Program EIR/EIS should address the broad issues related to the development of a proposed HST system. Based on the information developed in the earlier studies discussed above, as well as through public and agency coordination and scoping, the Authority and the FRA were able to identify potential corridors for development of a proposed HST system. To obtain a thorough understanding of potential impacts, the Authority and the FRA also decided to consider other potential transportation improvements that could serve as an alternative to the proposed HST in addressing the purpose and need.

In the State of California, there are conventional passenger trains and commercial intercity buses, but air and highway travel are clearly the predominant modes for intercity trips, particularly for trips over 150 miles (mi) (240 kilometers [km]). Because the No Project Alternative would likely not satisfy the projected increased intercity travel demand, the Authority, the FRA, and cooperating agencies concluded it was appropriate to consider a potentially feasible modal alternative that could respond to the level of increased representative demand for intercity travel that the proposed HST Alternative could serve. The Modal Alternative considered herein focuses on currently available intercity modes of transportation and consists of hypothetical future improvements to a combination of highways and airports serving the same geographic areas as the proposed HST Alternative. The Modal Alternative was developed to provide a similar level of capacity to serve a "representative demand"[1] for intercity travel. The Modal Alternative was developed to meet demand, not capacity, to provide a realistic comparison between alternatives.

Intercity Travel Demand

Population in California is projected to increase 30% by the year 2020. That growth equates to more than 11 million people (U.S. Census Bureau 2000; California Department of Finance 1998). Because of trends in travel demand, congestion, and other adverse travel conditions, the market for intercity travel in California that the proposed HST system could serve is projected to grow by up to 63% over the next 20 years. According to the intercity travel demand forecasts prepared by Charles River Associates for the Authority, the HST system would carry at least 32 million passengers per year by 2020. These estimates are conservatively based on costs, travel times, and congestion levels for air and automobile transportation from 1997 to 2000. Analyses performed as part of the independent ridership and revenue forecasts prepared for the Authority (Charles River Associates 2000), using assumptions of increased growth of intercity trips, costs, and congestion of air and automobile travel, resulted in potential ridership for intercity HST system almost twice as high (more than 58 million annual intercity passengers for 2020). The proposed system is also forecast to carry nearly 38,000 commuters every weekday by 2020, or about 10 million commuter passengers annually.

These ridership forecasts were prepared in 1999–2000 for the Business Plan. They were based on the identified "highest return on investment route" for purposes of economic and financial analysis and are the best projections currently available for a representative HST system.[2] Ridership for this system was estimated to vary between 42 million passengers on the low end and 68 million passengers on the high end (10 million riders are long-distance commuters) for 2020, with a potential for considerably higher ridership beyond 2020. The purpose of and need for this project is to meet a part of California's future intercity travel demand in 2020 and beyond. While the HST system would have the capacity to carry many more passengers than the projected ridership by using longer trains, double-decker cars, or more frequent service (e.g., the Tokaido system in Japan carries more than 130 million passengers annually), the system alternatives are based on the higher ridership forecast because it provides a reasonable estimate of the number of passengers that might be expected to be carried in 2020 or beyond.

For this Program EIR/EIS, the higher ridership forecast of 58 million intercity trips (based on the sensitivity analysis as described in Chapter 1), together with the 10 million commute trips figure, provides a reasonable representation of total capacity and serves as a representative worst-case scenario for analyzing the potential environmental impacts from the physical and operational aspects of the system alternatives in 2020. This higher forecast is generally used as a basis for defining the system alternatives and is referred to hereafter as the *representative demand*. In some specific analyses (e.g., energy, air quality, and transportation), the high-end forecasts would result in potential benefits. In those cases, additional analysis is included in this Program EIS/EIR to address the impacts associated with the lower ridership forecasts.

HST Alternative Development

The Authority and the FRA started developing the HST alternative by seeking to identify the most reasonable and practicable HST technologies, corridors, alignments, and stations for analysis in this Program EIR/EIS. As part of this process, HST technologies and corridors previously

[1] The *representative demand* is approximately 58 million intercity trips (the higher forecast) and 10 million long-distance commute trips, totaling 68 million annual trips. The 68 million annual trips primarily represent trips that could be diverted from another mode (i.e., auto or air) to an HST system, if it were available.

[2] The route identified as having the highest return on investment was the 700-mi (1,127-km) system selected to represent the best investment opportunities and was used by the Authority in preparation of the full-funding scenario presented in the Business Plan.

considered were reevaluated and a screening evaluation of potential HST alignment and station options was conducted. This screening evaluation analyzed all reasonable and practical alignment and station options for viable technologies within viable HST corridors.

The evaluation of potential HST corridors, technologies, alignments, and stations used the following standardized criteria.

- Construction: Substantial engineering and construction complexity as well as excessive initial and/or recurring costs were considered criteria for project impracticability because they present logistical constraints.
- Environment: A high potential for considerable impacts on natural resources, including waters, streams, floodplains, wetlands, and habitat of threatened or endangered species was considered a criterion for failing to meet project objectives.
- Land Use Compatibility: Substantial incompatibility with current or planned local land use as defined in local plans was considered a criterion for failing to meet project objectives.
- Right-of-Way: A lack of available right-of-way or extensive right-of-way needs that would result in excessively high acquisition costs for a corridor, technology, alignment, or station was considered criteria for project impracticability.
- Connectivity/Accessibility: Limited connectivity with other transportation modes (aviation, highway, and/or transit systems) that would impair the service quality and could reduce ridership of the HST system was considered a criterion for failing to satisfy the project purpose.
- Ridership/Revenue: Longer trip times and/or suboptimal operating characteristics (such as reduced frequencies to major markets, or inability to directly serve major markets) that would result in low ridership and revenue and impair the economic feasibility of the HST system were considered criteria for failing to satisfy the project purpose.

To simplify the evaluation of HST alignment and station options, the state was divided into five geographic regions or travel markets that are used throughout this Program EIR/EIS, as shown in Figure 2.1-1. Previous Commission and Authority studies, as described in Section 2.3.1 were reviewed and reevaluated to develop HST alignment and station options in the five regions. The screening evaluation of alignment and station options comprised the following key activities.

- Review of past alignment and station options identified within viable corridors in previous studies.
- Identification through the environmental scoping process of alignment and station options not previously evaluated.
- Evaluation of alignment and station options using standardized engineering, environmental, and financial criteria (described above) and evaluation methodologies at a consistent level of analysis.
- Identification of the ability of alignment and station options to meet defined objectives.

The results of five regional studies were documented in the *California High-Speed Train Screening Report* (California High Speed Rail Authority 2002). The technical data provided in the screening evaluation, combined with public and agency input, provided the Authority and the FRA with the necessary information to focus further studies for the Program EIR/EIS on those alignments, station locations, and HST systems that represent a reasonable range of practicable alternatives to meet the project purpose and attain several objectives established by the Authority. Those objectives include the following.

- Maximize ridership and revenue potential.
- Maximize connectivity and accessibility.
- Maximize compatibility with existing and planned development.
- Maximize avoidance of areas with geological and soils constraints.
- Maximize avoidance of areas with potential hazardous materials.
- Minimize operating and capital costs.
- Minimize impacts on natural resources.
- Minimize impacts on social and economic resources.
- Minimize impacts on cultural resources.

As part of the screening evaluation, the Authority directed specific alignment refinement studies to provide additional technical information for the screening decisions to be made in the northern and southern mountain passes. In some areas, the alignments considered in this screening process are largely constrained by land use issues and associated environmental resources. This was not necessarily the case in the northern mountain crossing (Diablo Mountain Range) between the Central Valley and the San Francisco Bay Area, and the southern mountain crossing (Tehachapi Mountain Range) between Los Angeles and Bakersfield, which are more constrained by physical features and associated environmental resources. While previous studies provided preliminary evaluations of these areas, screening decisions were complicated by the vast potential for variation in specific alignment (horizontal and vertical) and associated costs and impacts. Even in areas like the southern mountain crossing where the studies have focused on three primary corridors, differing alignment and grade options within any one corridor would present considerable differences in cost and impact.

Given the potential for a wide range of impacts in the mountain passes, the Authority completed a review of tunneling considerations, including a two-day technical conference and an alignment optimization and refinement study using the Quantm system[3] to assist in the screening review. The alignment refinement study also included further consideration of tunneling assumptions and parameters. The mountain range crossing for the proposed HST system would present difficult terrain and require extensive tunneling to accomplish the necessary traversing alignments. In the screening evaluation, alignment options were considered that could require a total of more than 80 mi (129 km) of twin-tube tunneling, including the potential for continuous tunnel segments of more than 30 mi (48 km). Crossing the Tehachapi Mountains between Los Angeles and Bakersfield could require 30 to 45 total mi (48 to 72 km) of tunneling in extremely challenging seismic and geologic conditions. These mountain crossings and the required tunneling would represent serious challenges for the construction of a proposed HST system. Relative certainty and confidence in the feasibility of the proposed tunneling and associated cost estimates were of critical importance to the screening evaluation.

To address the complex issues associated with the tunneling required for the statewide HST system, the Authority held a technical tunneling conference on December 3 and 4, 2001, in the Los Angeles area. The conference was attended by tunneling contractors, specialized tunnel engineers, geologists/geotechnical engineers, and representatives of the program management and regional study consultant teams, as well as Authority staff. The conference focused on gaining additional insights and input regarding feasibility, construction methods, and cost

[3] The Quantm system is a unique, state-of-the-art, automated route selection and optimization tool that performs automated alignment searches and corridor screening based on client- or user-specified geometry, constraints, and cost parameters. While Quantm has been widely used and proven in Australia, it has only recently become available for application in the United States. The Authority's work is the first application of this optimization system in North America.

assumptions associated with proposed tunneling for the HST system. The attendees generally concurred with the tunneling assumptions that had been previously applied for the screening evaluation. The attendees acknowledged the Authority's objective of minimizing the amount of tunneling required, particularly the use of long tunnels (more than 6 mi [10 km] long), due to cost, time of construction, and potential for delay. Tunnels more than 12 mi (19 km) long were considered infeasible for this project. The attendees also acknowledged the Authority's objective of crossing major fault zones at grade. The technical information produced by the tunneling conference is documented in the *Tunneling Issues Report* (California High Speed Rail Authority January 2004).

The alignment refinement/optimization study incorporated conclusions from the tunneling conference and further clarified and strengthened the technical basis for making screening-level decisions regarding potential HST corridors in the northern and southern mountain crossings. The study analyzed a broad range of horizontal and vertical alignment options using the Quantm system to provide more confidence that optimal alignments are being considered and more certainty concerning the cost estimates and potential impacts of each alignment option. The study focused on the following three objectives.

- Confirm the general corridors considered in the screening studies to date and/or identify any other corridors of equal or greater viability that may have been overlooked in previous studies.
- Refine the alignment options in each general corridor to identify the most viable options in terms of infrastructure requirements and impact avoidance/minimization.
- Test the sensitivity of the alignment options in each corridor based on key defining criteria such as vertical grade, alignment geometry, infrastructure (e.g., tunnel and structure) costs, and key environmental constraints.

Many individual alignment options were considered in each of the primary corridors in each mountain crossing, and each alignment was evaluated for maximum vertical grades of 2.5% and 3.5%. The Quantm system identified, located, and quantified the cost of approximately 12 million alignment options for each mountain crossing and provided a range of optimal alignments to choose from.

The alignment refinement studies provided a means to minimize tunneling and capital costs while avoiding or minimizing potential impacts on natural resources and other sensitive areas (e.g., natural communities and national forests). These sensitive areas were input to the Quantm system from the geographic information systems (GIS) environmental database and were included as constraints to the iterative alignment refinement process. The alignment refinement studies advanced the design of the HST options to support the screening evaluation in the mountain passes and are documented in the *Alignment Refinement/Optimization and Evaluation of the Quantm System* (California High Speed Rail Authority April 2002).

At the January 2002 Authority governing board meeting, board members reviewed the process and results and identified the alternatives recommended for analysis in this Program EIR/EIS. The board recommended several alignment and station options, and also recommended further study of steel-wheel-on-steel-rail as a technology option in the program-level environmental analysis. The board did not recommend further study of magnetic levitation as a proposed technology for the HST system. The FRA concurred with the recommendation for alternatives to be evaluated as part of the environmental review process.

2.3.3 Related Projects

For the past seven years, SCAG has been studying the feasibility of using maglev technology for regional high-speed transportation in the Los Angeles area. SCAG studies have focused on using a maglev system for commuter transportation and to connect regional airports in Southern California. SCAG envisions a 275-mile maglev system that would accommodate growing travel demand and relieve freeways. Current activities are focused on an initial line that would travel from West Los Angeles near to LAX to Ontario airport, paralleling the inland Los Angeles to San Diego route of the HST system. Other maglev lines would duplicate the Palmdale to Los Angeles, Los Angeles to San Diego, and Los Angeles to Orange County segments of the HST system. Figure 2.3-4 illustrates the overall maglev system. SCAG has completed the following planning studies:

- LAX to March Global Port, Riverside County
- LAX to Palmdale Regional Airport
- Los Angeles Union Passenger Terminal (LAUPT) to Anaheim, Orange County
- LAX to Irvine Transportation Center in South Orange County
- IOS - West Los Angeles to Ontario Airport

In addition, a Notice of Intent to prepare a Programmatic EIS has been issued by the FRA and the Nevada Department of Transportation for maglev service between Anaheim, California and Las Vegas, Nevada (a distance of approximately 270 miles).

As the federal lead agency for this Program EIR/EIS, the FRA will continue to coordinate Federal review of the HST system with the proposed Anaheim-Las Vegas and SCAG maglev concepts in Southern California. In addition, the Authority will coordinate with SCAG, the Nevada Department of Transportation, and other project sponsors during subsequent phases of HST system development and implementation particularly with regard to potential connections at HST stations as well as possible alignment and service plan conflicts or synergies.

2.4 NO PROJECT ALTERNATIVE

The No Project Alternative is the basis for comparison of the Modal and HST Alternatives. The No Project Alternative represents the state's transportation system (highway, air, and conventional rail) as it is currently and as it would be after implementation of programs or projects that are currently projected in regional transportation plans (RTPs), have identified funds for implementation, and are expected to be in place by 2020. This financially constrained level of infrastructure improvement (based on the expected federal, state, regional, and local funding) was analyzed in consideration of the considerable growth in population and transportation demand that is projected to occur by 2020. The No Project Alternative addresses the geographic area that serves the major destination markets for intercity travel and that would be served by the proposed HST Alternative. This area extends generally from the San Francisco Bay Area and Sacramento through the Central Valley to Los Angeles and San Diego. Figure 2.4-1 illustrates the existing intercity transportation infrastructure that currently serves these major travel markets.

The No Project Alternative satisfies the statutory requirements under CEQA and NEPA for an alternative that does not include any new action or project beyond what is already committed. The No Project Alternative defines the existing and future statewide intercity transportation system based on programmed and funded improvements through 2020, according to the following sources of information.

- State Transportation Implementation Program (STIP).
- RTPs, financially constrained projects for all modes of travel.

- Airport plans.
- Intercity passenger rail plans.

The future improvements that would be part of the No Project Alternative are also included under both the Modal and HST Alternatives as part of the future 2020 baseline. No Project includes highway, aviation, and conventional rail elements, as discussed below.

2.4.1 Highway Element

The No Project highway system that currently serves the intercity travel market in the area proposed to be served by the HST Alternative includes the existing routes identified in Table 2.4-1, and illustrated in Figure 2.4-1. The No Project Alternative includes this existing highway system as well as funded and programmed improvements on the intercity highway network based on financially constrained RTPs developed by regional transportation planning agencies. Intercity highway improvements included as part of the No Project Alternative include infrastructure projects, as well as intelligent transportation system (ITS) and other potential system improvements programmed to be in operation by 2020. The improvements consist primarily of individual interchange improvements and roadway widening projects on limited segments of the highway network. As such, the improvements do not cumulatively add considerable line capacity to the highway system. The intercity highway improvements included as part of the No Project Alternative are identified by county in Appendix 2-A.

Table 2.4-1
Existing California Intercity Highway System

Interstate Highways	U.S. Highways	State Routes
Interstate 5 (I-5)	U.S. Highway 101 (US-101)	State Route 14 (SR-14)
Interstate 8 (I-8)		State Route 58 (SR-58)
Interstate 10 (I-10)		State Route 65 (SR-65)
Interstate 15 (I-15)		State Route 91 (SR-91)
Interstate 80 (I-80)		State Route 99 (SR-99)
Interstate 105 (I-105)		State Route 120 (SR-120)
Interstate 205 (I-205)		State Route 152 (SR-152)
Interstate 215 (I-215)		
Interstate 405 (I-405)		
Interstate 280 (I-280)		
Interstate 580 (I-580)		
Interstate 680 (I-680)		

2.4.2 Aviation Element

The air transportation system evaluated under the No Project Alternative consists of 18 airports that currently provide commercial service in the area proposed to be served by the HST Alternative (study area). The airports do not necessarily provide commercial service between the same intercity markets as the proposed HST system. These airports are illustrated in Figure 2.4-1 and listed below.

- Sonoma County Airport/Santa Rosa Airport (STS).
- Sacramento International Airport (SMF).

- Stockton Metropolitan Airport (SCK)[4].
- San Francisco International Airport (SFO).
- Oakland International Airport (OAK).
- Norman Y. Mineta San Jose International Airport (SJC).
- Modesto City-County-Harry Sham Field (MOD).
- Merced Municipal/Macready Field (MCE).
- Fresno Yosemite International Airport (FAT).
- Visalia Municipal Airport (VIS).
- Bakersfield Meadows Field Airport (BFL).
- Burbank-Glendale-Pasadena Airport (BUR).
- Los Angeles International Airport (LAX).
- Long Beach Daugherty Field (LGB).
- John Wayne International-Orange County Airport (SNA).
- Ontario International Airport (ONT).
- McClellan-Palomar Airport (CLQ) (Carlsbad).
- San Diego International Airport-Lindbergh Field (SAN).

Statewide, the airport development process is distinct from the highway and rail development processes and is not documented in local/regional transportation plans or in the STIP. In addition, because many airport improvements are funded with a combination of public and private funds, there is limited formal public documentation identifying committed projects that are likely to be operational by 2020.

For this analysis and to conceptualize a 2020 No Project airport system, criteria for airport development were developed to review proposed projects and determine their likelihood for implementation and operation by the year 2020. Proposed airport improvements were evaluated based on a review of available documentation, interviews with airport planning and development professionals, local area knowledge, and public agency input. An airport improvement is deemed likely to be implemented and operational by 2020 if the improvement meets the following criteria.

- Has been identified in an approved or under-development airport master planning program, environmental document, regional aviation system planning document, or capital improvement program.
- Is reasonably practical to place into operation by 2020.

By applying this approach, the airport improvements likely to be funded, programmed, and operational by 2020 are summarized in Table 2.4-2.

Only a portion of the programmed, funded, and potentially operational improvements for 2020 are related to California intercity trips entirely made within the state. The projected aviation improvements were adjusted to represent only the intra-California proportional share, based on the Passenger Survey for California Market Demand in the *Official Airline Guide [OAG]* (Parsons Brinckerhoff 2002) as summarized in Table 2.4-3. The addition of this proportion of improvements to the existing 2001 airport

[4] America West stopped commercial services in September 2003. San Joaquin County is actively seeking new commercial carriers.

facilities and aviation system is represented in the No Project Alternative. Appendix 2-B provides a detailed description of the aviation element of the No Project Alternative.

Table 2.4-2
Assumed Total Programmed, Funded, and Operational Airport Improvements[a]

Airport	Passenger Terminal Size (square feet)	Runways	Gates	Primary Access Lanes	Parking Spaces (On-/Off-Site)
Bay Area					
Oakland (OAK)	320,000	0	12	2[5]	10,000
San Jose (SJC)	500,000	0	17	2	6,400
Northern Central Valley					
Sacramento (SMF)	250,000	0	14	1	5,000
Southern Central Valley					
Fresno (FAT)	188,000	0	5	1	1,800
Los Angeles					
Ontario (ONT)	800,000	0	24	4	5,000
San Diego					
San Diego (SAN)	200,000	0	8	2	3,000
Statewide Total[b]	**2,258,000**	**0**	**80**	**12**	**31,200**

[a] Total improvements assumed to be programmed, funded, and operational by 2020.

[b] The City and County of San Francisco and the FAA have commenced preparation of an EIR/EIS for a runway expansion/reconfiguration at SFO that may occur before 2020. It is not assumed as part of the No Project improvements since it does not meet the criteria as established.

Sources: Master planning and environmental documents, regional aviation system planning documents, and interviews with local area airport staff and airport planners (see Chapter 12).

Table 2.4-3
Assumed Programmed, Funded, and Operational Improvements
Adjusted for Trips Inside California*

Airport	Passenger Terminal Size (square feet)	Runways	Gates	Highway Lanes	Parking Spaces (On-/Off-Site)
Bay Area					
Oakland (OAK)	192,000	0	7	1	6,010
San Jose (SJC)	245,000	0	8	1	3,140
Northern Central Valley					
Sacramento (SMF)	102,500	0	6	0	2,050
Southern Central Valley					
Fresno (FAT)	112,800	0	3	1	1,080
Los Angeles					
Ontario (ONT)	512,000	0	15	1	3,200

[5] Includes the Oakland Airport Connector project, which is currently under construction for completion in spring 2005. The connector is a 3 (approx.)-mile people mover, operating on exclusive guideway connecting the Oakland International Airport to the BART Coliseum Station.

Airport	Passenger Terminal Size (square feet)	Runways	Gates	Highway Lanes	Parking Spaces (On-/Off-Site)
San Diego					
San Diego (SAN)	54,000	0	2	1	810
Statewide Total	**1,218,300**	**0**	**41**	**5**	**16,290**

* Adjusted to represent the proportional share of improvements by 2020 for intercity California trips only. Assumed intercity California trips are Oakland 60%, San Jose 49%, Fresno 60%, Sacramento 41%, Ontario 64%, and San Diego 27%.

Source: *Official Airline Guide (OAG) Passenger Survey for California Market Demand*, August 2002. Parsons Brinckerhoff, November 2002.

2.4.3 Conventional Passenger Rail Element

Existing intercity passenger rail service is provided on four principal corridors covering more than 1,300 route mi (2,092 route km) and spanning almost the entire state. The No Project passenger rail network is composed of three of these corridors (capitol corridor, Pacific Surfliner corridor, and San Joaquin corridor) as illustrated in Figure 2.4-1 and described below. The fourth corridor, the coastal corridor, is not included as part of the No Project Alternative because it does not serve the major intercity market (Los Angeles to San Francisco) with competitive frequency or travel time. It primarily serves the intermediate markets (coastal cities).

Within these corridors, the intercity passenger service currently shares track with freight and/or commuter services. The primary portions of these corridors serve the same intercity markets as the proposed HST Alternative. All the intercity passenger rail system improvements identified in the STIP and the Caltrans California Intercity Rail Capital Program for implementation prior to 2020 are included in the No Project Alternative and are identified in Appendix 2-C. To increase levels of passenger service, the improvements consist of additional track capacity, maintenance and storage facilities, grade-crossing improvements, track and signal improvements, and expanded or upgraded passenger stations.

2.5 MODAL ALTERNATIVE

Four options exist for intercity travel between the major urban areas of California.

- Vehicles on the interstate highway system and state highways.
- Commercial airlines serving airports.
- Conventional passenger trains (Amtrak) on freight and/or commuter rail tracks.
- Long-distance commercial bus transit.

The Authority and the FRA developed a modal alternative that focuses on intercity modes of transportation other than high-speed rail. Air and highway travel are clearly the predominant modes for intercity trips, in particular intercity trips longer than 150 mi (241 km). The Modal Alternative consists of hypothetical future expansions of highways and airports serving the same geographic areas as the proposed HST system. For consistency, the Modal Alternative was developed to provide equivalent capacity to serve the representative demand for intercity travel that was derived from the higher ridership forecasts from the sensitivity analysis completed for the HST system operating in 2020, as described in Chapter 1. As described above in Section 2.3-2, the representative demand is based on the independent ridership and revenue forecasts prepared for the Authority by Charles River Associates (2000).

The 2020 ridership forecasts used in the Business Plan varied between 42 million and 68 million passengers (10 million riders of which are long-distance commuters), depending on key assumptions regarding future travel cost and congestion levels as well as higher growth rates for intercity trips. The purpose of and need for this project is to meet part of California's future intercity travel demand in 2020 and beyond. Therefore, the high end of the forecast range (68 million annual passengers) is assumed as a basis for defining the level of improvement for the HST Alternative as well as the Modal Alternative. The representative demand comprises approximately 58 million intercity trips (the high-end forecast) and 10 million long-distance commute trips, totaling 68 million annual trips. The 68 million annual trips primarily represent trips that would be diverted from another mode (i.e., auto, rail, or plane) to an HST system, if it were available.

The representative intercity 2020 travel *demand*, rather than the HST *capacity*, is used as the basis for defining the hypothetical modal improvements because it is consistent with the project purpose and need. Because the HST Alternative has such a high capacity potential, using the HST capacity as the basis to define modal alternatives would overstate the amount of improvement needed for 2020 and the foreseeable future. While the HST system would have the capacity to carry many more passengers than those accounted for in the representative demand (e.g., the Tokaido Line in Japan carries more than 130 million passengers per year), the system alternatives are based on the 2020 forecast because it provides a reasonable estimate of the number of passengers that might be expected to be carried on the high-speed rail infrastructure in the foreseeable future. Developing a modal alternative that provided a maximum level of capacity similar to the HST system would result in extensive infrastructure improvements that would be considered unreasonable. Defining a modal alternative based on a level of capital expenditure similar to that of the HST rather than based on representative demand would result in a level of improvement that would not necessarily relate to the forecasted demand.

In developing the Modal Alternative to analyze in this Program EIR/EIS, analyses were conducted to identify the most reasonable, feasible, and practicable modal improvements that could best meet the project purpose and need and objectives. The analyses also assessed the appropriateness of accommodating the representative demand within a single mode of transportation. The improvements considered for each mode are capacity-oriented (e.g., additional traffic lanes for highways with associated interchange reconfiguration and ramp improvements; additional gates and runways for airports with associated taxiways, parking, and passenger terminal facilities), and this corresponds to the representative demand for a proposed HST system.

2.5.1 Modal Alternatives Considered and Rejected

A. HIGHWAY SYSTEM IMPROVEMENTS ONLY

In the development of the Modal Alternative, an analysis was conducted to assess the appropriateness of accommodating the representative demand solely within the highway mode of intercity transportation. The analysis showed that it would not be practical or feasible for highway improvements alone to serve the range of intercity trip lengths. The analysis also showed that highway improvements alone would not meet the purpose and need and objectives of the proposed HST system in terms of reliability, safety, and preservation of the state's natural resources.

Overall, the highway improvement options represent a total of 3,300 lane mi (5,311 km) of new highway construction. In the central portion of the study area, including the Tehachapi Mountain crossing, as many as six additional highway lanes (expanding I-5 and State Route 14 [SR-14]/SR-58) would be necessary to serve the forecasted demand. This level of infrastructure improvement would be difficult to meet because of the terrain and right-of-way constraints.

In addition, increasing the highway capacity through the central portions of the study area would not considerably reduce highway travel times for longer distance trips (e.g., Los Angeles to San Francisco). Trip distance would still be a determining factor in the modal choice between air and automobile travel, and it is unlikely that the majority of the longer distance trips would be by auto. Feasibility concerns are also raised by the considerable capacity improvements identified for existing and planned highway facilities in congested urban regions of the study area that have used all available rights-of-way. It is generally not feasible to add considerable capacity to the existing facilities or create new corridors in these areas because high costs and impacts would be incurred in acquiring and preparing new rights-of-way.

There is also concern about the viability of relying solely on expanded highways for intercity trips through heavily congested urban areas, because in many cases the existing urban freeways are so congested that any additional capacity would serve to simply meet forecasted urban/commute traffic demand. Adding lanes to these facilities may have no more effect than to lessen the existing peak congestion period or allow current demand to use the facility during peak usage periods. This would leave no measurable increase in capacity to serve the intercity travel demand. The highway improvements associated with this scenario are documented in Appendix 2-D.

B. AVIATION IMPROVEMENTS ONLY

In the development of the Modal Alternative, an analysis was conducted to assess the appropriateness of accommodating the representative demand solely within the aviation mode of intercity transportation. The analysis showed that it is not practical or feasible to assume that improvements to the aviation system alone could accommodate all of the representative intercity travel demand.

Air travel would not be competitive for trips less than 150 mi (240 km). The automobile is the most competitive travel mode for these trips in terms of convenience, cost, and journey time. For a typical 150-mi (240-km) trip within the study area, it is estimated that the total journey time by private auto would be about 3 hours (hrs) or less (assuming an average speed of 50 mph, or 80 kph) compared to about 3 to 4 hrs by air (assuming 1 to 1.5 hrs for access/egress to and from the airport and point of origin, 1 hr pre-board check-in arrival time, 30 minutes (min) deplaning/baggage claim time, and 30-min to 1-hr flight time). In addition, trips by private auto are not limited to scheduled arrival and departure times, and they are less affected by weather delays.

The magnitude of aviation improvements required to accommodate the representative intercity demand is clearly not practical considering current airport utilization levels along with the land use, environmental, and other capacity constraints that limit airport expansion projects. The aviation improvements associated with this scenario are documented in Appendix 2-E.

C. CONVENTIONAL PASSENGER RAIL IMPROVEMENTS ONLY

Consideration was given to improving the conventional passenger rail system to accommodate all or part of the representative demand in the same geographic markets as the proposed HST Alternative. Conventional intercity rail was not given further consideration as a stand-alone alternative or as part of the development of the Modal Alternative because it would not provide or assist in providing a competitive option to satisfy much of the representative intercity demand that the Modal Alternative is designed to capture.

It is estimated that conventional intercity rail would serve only 1% of the representative demand because it attracts trips that are less sensitive to travel time and more sensitive to cost, and require shorter travel distances (based on the *Independent Ridership and Passenger Revenue Projections for High-Speed Rail Alternatives in California, Draft Final Report* [Charles River Associates 2000]). Because conventional rail shares track with freight trains that can interfere with passenger train schedules, and because existing tracks have curves and grade changes that are designed for slower speeds, the travel times for conventional rail are not competitive with the other modes of intercity travel. For example, under existing conditions the total travel time on Amtrak's San Joaquin service between Los Angeles and San Francisco is 10 hrs and 5 min. Even with full implementation of planned improvements, the travel time can only be reduced to 8 hrs and 30 min (Amtrak 2000),[6] and the service would still require transferring to buses to travel between Emeryville and San Francisco and between Bakersfield and Los Angeles.

2.5.2 Modal Alternative Carried Forward

As discussed in the previous section, a single mode (highway, aviation, or conventional passenger rail) would not effectively serve the various trip lengths and purposes of intercity trips. In addition, a single mode would not meet the fundamental purpose and need and objectives of the proposed HST system in terms of reliability, safety, and serving intercity travel demand. Further, intercity rail and commercial bus service do not provide a competitive option to serve the representative demand that the Modal Alternative is designed to capture (potential high-speed rail trips).

The Authority and the FRA have therefore developed a modal alternative that is a hybrid of future transportation improvement options in both the highway and aviation modes of intercity travel. It is assumed that the total representative demand would be split evenly between highway and air trips, based on the mode split estimated in the forecasts for intercity trips (58 million) and the direct assignment of the long-distance commute trips (10 million) to the highway mode. Hypothetical capacity improvements to the highway and aviation system were identified based on the forecast proportions of the representative intercity travel demand in each of these modes. These highway and aviation improvements represent an equivalent level of capacity to meet the representative demand. The highway and aviation components of the Modal Alternative are described below.

Transportation demand management options, like congestion management, were not considered as part of this alternative, since the effect of such options on the statewide intercity travel demand cannot be quantified at this level of study.

A. HIGHWAY COMPONENT

<u>Level of Improvement</u>

The highway component of the Modal Alternative consists of over 2,900 lane mi (4,667 km) of highway capacity added to the No Project highway network. Figure 2.5-1 presents the hypothetical improvements identified to serve the highway portion of the forecasted intercity travel demand. These capacity improvements are represented in numbers of lanes for broad segments of highway corridors. The hypothetical improvements reflect an equivalent level of capacity (as defined below under *Improvement Definition*) to serve the portion of the representative demand that would use highways, which is assumed to be 50% of the 68 million total annual trips in the representative demand or 34 million trips (24 million intercity and 10 million long-distance commute trips). This is the volume of highway trips expected to be diverted to a proposed HST system. To limit potential environmental impacts, the capacity improvements focused on expanding existing highways instead of creating new transportation corridors. Although the land area for widening existing facilities by one or two lanes would be similar to that required for the creation of new highways, widening existing highways would avoid many incompatibility and severance impacts, which could be considerable in both urban communities and rural settings such as farmlands and open spaces. In addition, few new transportation facilities are being planned by local, regional, and state agencies in the intercity corridors identified. For the limited cases where new facilities are being planned (e.g., SR-65 in the Central Valley), there is insufficient information available regarding the location and definition of the facility to adequately quantify potential impacts.

[6] Existing connecting bus travel times were used between Los Angeles and Bakersfield (2 hrs and 45 min with transfer time) and Emeryville to San Francisco (40 min with transfer time).

In cases where highway facilities for the No Project Alternative have been built to their operational limit (typically in dense urban areas), this analysis assumed that additional lanes would be placed over the existing facility on an aerial structure. Although this configuration would introduce more potential for visual impacts, total impacts would be considerably less than those that would result from introducing an entirely new corridor in a congested urban area. By developing this alternative the Authority and the FRA do not in any way recommend, endorse, or suggest that these improvements could or should be implemented on a specific highway or highway segment. Nor is it assumed that a proposed HST system would negate the potential need to expand highways in the state.

Improvement Definition

The *equivalent level of capacity* is the number of additional lanes that would be added to the highway corridor to serve the allocated highway portion of the representative demand, which is 34 million trips. These improvements are assumed to be in a specific corridor for the purposes of this analysis, but the improvements could also be made to parallel facilities in some cases. A detailed description of the highway improvement option methodology is found in Appendix 2-F.

Table 2.5-1 compares the additional lanes with the number of lanes that would exist in the No Project Alternative on each route segment to determine whether the improvement is defined as *widening* or a *new facility*. The additional lanes represent widening of the existing facility up to a total of 12 lanes, as shown in Figure 2.5-2, a typical cross-section of a highway widening. Beyond 12 total lanes, additional lanes are defined as a separate facility. Separate facilities in urban areas would be placed over the existing facility (elevated configuration of some lanes, up to two per direction) because of right-of-way constraints.

Associated Improvements

Additional improvements such as interchanges, bridge widenings, etc., would be needed in support of the added lanes. These associated improvements are defined in general terms based on engineering standards regarding size, extent, and placement.

Table 2.5-1
Definition of Highway Improvements

Highway Corridor	Segment (From–To)	No. of Additional Lanes[a] (Total–Both Directions)	No. of Existing Lanes (Total–Both Directions)	Type of Improvement
Bay Area to Merced				
US-101	SFO	2	8	Widening
US-101	SFO to Redwood City	2	8	Widening
US-101	Redwood City to I-880	2	8	Widening
I-880	US-101 to San Jose	2	8	Widening
US-101	San Jose to Gilroy	2	6	Widening
US-101	Gilroy to SR-152	2	4	Widening
SR-152	US-101 to I-5	2	2	Widening
SR-152	I-5 to SR-99	2	4	Widening
I-80	San Francisco to I-880	2	10	b
I-80	I-880 to I-5 (Sacramento)	2	8	Widening
I-880	I-80 to I-238	2	8	Widening
I-580	I-880 to I-5 (via I-238)	2	8	Widening
I-880	I-238 to Fremont/Newark	2	8	Widening

Highway Corridor	Segment (From–To)	No. of Additional Lanes[a] (Total–Both Directions)	No. of Existing Lanes (Total–Both Directions)	Type of Improvement
I-880	Fremont/Newark to US-101	2	6	Widening
Sacramento to Bakersfield				
I-5	I-80 to Stockton	2	6	Widening
I-5	Stockton to I-580/SR-120	2	6	Widening
I-5	I-580/SR-120 to SR-152	2	4	Widening
I-5	SR-152 to SR-99	2	4	Widening
SR-99	I-5 to SR-58	2	6	Widening
SR-99	Sacramento to SR-120	2	4	Widening
SR-99	SR-120 to Modesto	2	6	Widening
SR-99	Modesto to Merced	2	4	Widening
SR-99	Merced to SR-152	2	4	Widening
SR-99	SR-152 to Fresno	2	4	Widening
SR-99	Fresno to Tulare/Visalia	2	6	Widening
SR-99	Tulare/Visalia to SR-58	2	4	Widening
Bakersfield to Los Angeles				
I-5	SR-99 to SR-14	2	8	Widening
I-5	SR-14 to I-405	4	10	Separate facility
I-5	I-405 to Burbank	4	8	Widening
I-5	Burbank to Los Angeles Union Station (LAUS)	4	8	Widening
SR-58/14	SR-99 to Palmdale	0	4	Widening
SR-14	Palmdale to I-5	2	4	Widening
Los Angeles to San Diego via Orange County				
I-5	LAUS to I-10	4	8	Widening
I-5	I-10 to Norwalk	2	6	Widening
I-5	Norwalk to Anaheim	2	6	Widening
I-5	Anaheim to Irvine	2	10	Widening
I-5	Irvine to I-405	2	10	Widening
I-5	I-405 to SR-78	2	8	Widening
I-5	SR-78 to University Town Center (UTC)	2	8	Widening
I-5/I-8	UTC to San Diego Airport	2	8	Widening
I-8	SR-163 to I-5	2	8	Widening
Los Angeles to San Diego via Inland Empire				
I-10	I-5 to East San Gabriel Valley	2	10	Widening
I-10	East San Gabriel Airport to Ontario Airport	2	8	Widening
I-10	Ontario Airport to I-15	2	8	Widening
I-10	I-15 to I-215	2	8	Widening

Highway Corridor	Segment (From–To)	No. of Additional Lanes[a] (Total–Both Directions)	No. of Existing Lanes (Total–Both Directions)	Type of Improvement
I-15	I-10 to I-215	2	8	Widening
I-215	Riverside to I-15	2	4	Widening
I-215	I-10 to Riverside	2	6	Widening
I-15	I-215 to Temecula	2	10	Widening
I-15	Temecula to Escondido	2	8	Widening
I-15	Escondido to Mira Mesa	2	10	Widening
I-15	Mira Mesa to SR-163	2	10	Widening
SR-163	I-15 to I-8	2	8	Widening

[a] Represents the number of through lanes needed in addition to the total number of lanes in the No Project highway network to serve the representative demand.

[b] No additional or separate facility assumed. Additional demand is assumed to utilize the existing bridge, spreading the peak period congestion.

Source: Caltrans Highway Logs 2001

B. AVIATION COMPONENT

Level of Improvement

The remaining 50%, or approximately 34 million of the 68 million total intercity trips (representative demand), has been allocated to air as the preferred mode of travel. This is the volume of air trips expected to be diverted to a proposed HST system. This portion of the demand was then assigned to each region, based on the regional distribution of trips as forecasted (based on the *Independent Ridership and Passenger Revenue Projections for High Speed Rail Alternatives in California, Draft Final Report*, (Charles River Associates 2000). Hypothetical improvements (terminal gates, runways, and other associated improvements) were identified at individual airports within each region to accommodate this demand and assess the potential for environmental impact. The level of improvement required is the net capacity increase over the No Project Alternative to serve only intra-California trips, based on the existing proportions of intrastate versus out-of-state flight statistics. By developing this alternative the Authority and the FRA do not in any way recommend, endorse, or suggest that these improvements could or should be implemented at a specific airport. Nor is it assumed that a proposed HST system would negate the potential need to expand airports in the state.

The regional level of improvement (over and above the No Project Alternative) to accommodate representative intercity demand is summarized in Figure 2.5-3 and Table 2.5-2. Of the 18 airports in the study area, eight representative airports were identified to accommodate the additional improvements for the assessment of potential environmental impacts. To avoid the highly speculative nature of locating new airports, it is assumed that improvements would only occur at airports where there is currently existing intercity commercial airline passenger service.

Regional assumptions developed to identify which airports would accommodate the representative improvements are summarized below.

Bay Area: Future local/regional trips would shift from San Francisco International Airport to Oakland International Airport and the airport in San Jose to maintain sufficient capacity for long haul and international trips. Consistent with this strategy, it is assumed that all of the regional representative air demand and aircraft operations for the Bay Area would be accommodated at

Oakland or San Jose. This assumption is consistent with one of the proposed strategies identified in the Metropolitan Transportation Commission's *Regional Airport System Plan* (Metropolitan Transportation Commission 2000). This is also consistent with the current trend of air carriers choosing to shift regional air service to other airports in the region in the face of increasing capacity constraints at San Francisco International. San Francisco and Oakland airports are currently considering expansion.

<u>Southern San Joaquin Valley</u>: Fresno is the geographical and population center of the region, and the Fresno airport could accommodate all regional representative air demand and aircraft operations.

Table 2.5-2
Definition of Aviation Improvements

<table>
<tr><th>Regional Airport</th><th>Representative Intercity Demand (Millions)</th><th>Additional Gates (by Region)</th><th>Additional Runways (by Region)</th><th>Annual Passengers (Millions)</th><th>Number of Runways</th><th>Number of Gates</th></tr>
<tr><td colspan="7">Bay Area to Merced</td></tr>
<tr><td>Oakland</td><td rowspan="4">13.2</td><td rowspan="4">35</td><td rowspan="4">2</td><td>11.4</td><td>3</td><td>24</td></tr>
<tr><td>San Jose</td><td>13.1</td><td>3</td><td>31</td></tr>
<tr><td>San Francisco</td><td>33.9</td><td>4</td><td>117</td></tr>
<tr><td>Santa Rosa</td><td>0.08</td><td>2</td><td>1</td></tr>
<tr><td colspan="7">Northern Central Valley</td></tr>
<tr><td>Sacramento</td><td rowspan="2">3.1</td><td rowspan="2">6</td><td rowspan="2">0</td><td>7.5</td><td>2</td><td>30</td></tr>
<tr><td>Stockton</td><td>n/a</td><td>2</td><td>6</td></tr>
<tr><td colspan="7">Southern Central Valley</td></tr>
<tr><td>Bakersfield</td><td rowspan="5">0.5</td><td rowspan="5">2</td><td rowspan="5">0</td><td>1.4</td><td>2</td><td>12</td></tr>
<tr><td>Visalia</td><td>0.3</td><td>2</td><td>7</td></tr>
<tr><td>Fresno</td><td>0.01</td><td>1</td><td>1</td></tr>
<tr><td>Merced</td><td>0.03</td><td>2</td><td>1</td></tr>
<tr><td>Modesto</td><td>0.1</td><td>1</td><td>1</td></tr>
<tr><td colspan="7">Los Angeles</td></tr>
<tr><td>Burbank</td><td rowspan="5">13.5</td><td rowspan="5">36</td><td rowspan="5">2</td><td>4.7</td><td>2</td><td>14</td></tr>
<tr><td>Los Angeles</td><td>61.6</td><td>4</td><td>140</td></tr>
<tr><td>Long Beach</td><td>7.3</td><td>2</td><td>14</td></tr>
<tr><td>Orange County</td><td>6.7</td><td>2</td><td>26</td></tr>
<tr><td>Ontario</td><td>0.6</td><td>5</td><td>9</td></tr>
<tr><td colspan="7">San Diego</td></tr>
<tr><td>San Diego</td><td rowspan="2">3.5</td><td rowspan="2">12</td><td rowspan="2">1</td><td>15.1</td><td>1</td><td>41</td></tr>
<tr><td>Carlsbad</td><td>0.1</td><td>1</td><td>1</td></tr>
<tr><td>Totals</td><td>34</td><td>91</td><td>5</td><td>163.9</td><td>41</td><td>476</td></tr>
<tr><td colspan="7">Source: Airport Master Plans</td></tr>
</table>

<u>Northern San Joaquin/Sacramento Valley</u>: Regional representative intercity demand could be accommodated at a single airport, and Sacramento is currently planning an expansion and associated improvements.

Los Angeles Basin: It is assumed that air carriers would choose to shift regional service to other satellite airports in the face of increasing capacity constraints for long haul and international flights at LAX. While LAX may continue to provide regional service, it is assumed that all of the regional representative air demand and aircraft operations for the Los Angeles region would be accommodated at Ontario, Burbank, and Long Beach. The southern California Area Government's *Regional Aviation Plan for the 2001 Regional Transportation Plan* (Southern California Area Governments 2001) suggests that Ontario is expected to absorb the majority of passengers that are expected to shift to other airports in the region as LAX becomes increasingly capacity constrained. The City of Los Angeles and the FAA are preparing an EIR/EIS for a proposed master plan of improvements for LAX, including some runway reconfiguration of the existing four parallel runway system. Additionally, it was assumed that other needed regional improvements would be located at Burbank and Long Beach because of their proximity to central Los Angeles. (Even though Burbank and Long Beach airports have considerable noise abatement, land use, and other operating constraints, improvements are considered for planning purposes only and to estimate potential impacts.) Long Beach Airport currently has flight limitations (related to noise) that effectively limit passenger capacity to 3 million to 3.5 million annually. John Wayne/Orange County Airport was not considered because of specific limitations (annual passenger cap, curfew, gate limits) that restrict the capacity of the airport (Southern California Area Governments 2001).

San Diego: It is assumed that all of the regional representative intercity demand would be accommodated at SAN. The San Diego airport is expected to reach its projected physical capacity of 337,000 annual operations and 24.4 million annual passengers between 2020 and 2025. The San Diego Association of Governments and the San Diego Coast Regional Airport Authority are developing an air transportation action program to determine if Lindbergh Field can be combined with or replaced by another airport site to meet long-term passenger and cargo demand (FAA communication 11-18-02). According to the *2020 Regional Transportation Plan*, future landside and airside improvements will be located at San Diego until another site becomes available. At present, no other sites have been identified (San Diego Association of Governments 2000).

It is estimated that the Modal Alternative would require 91 additional airport terminal passenger gates and five additional runways at airports throughout the study area. Figure 2.5-3 summarizes the required improvements by region.

Improvement Definition

Aviation improvements (gates and runways) were quantified by region and assigned to existing facilities, unless specific constraints or policies prohibit expansion. Specific constraints at each airport facility were considered and capacity improvements were assigned to airports on a case-by-case basis. The current assumptions regarding the assignment of new gates and runways to specific airports are described above. For the environmental analyses, these facilities are represented in terms of additional right-of-way (physical footprint on- and off-site), additional parking spaces (on- and off-site), and additional primary lanes of access road. A detailed discussion of the methodology for determining aviation improvements is found in Appendix 2-G.

Associated Improvements

Other improvements such as taxiways, passenger facilities, additional lanes of secondary (service) access roadway, etc., would be needed in support of the new gates and runways. These associated improvements are defined in general terms based on engineering standards regarding size, extent, or placement.

2.6 HIGH-SPEED TRAIN ALTERNATIVE

The HST Alternative represents the proposed action and was developed by considering a range of potential HST technologies, corridors, and alignment and station options within the corridors. Informed by previous studies and the scoping process, the Authority and the FRA evaluated potential HST corridors and defined those that best met the project purpose, which is to provide a reliable mode of travel that links the major metropolitan areas of the state and delivers predictable and consistent travel times. A further objective is, in a manner sensitive to and protective of California's unique natural resources, to provide an interface with commercial airports, mass transit, and the highway network and to relieve the capacity constraints of the existing transportation system as intercity travel demand increases in California. Through the screening process, reasonable and feasible technology, alignment, and station options were identified for analysis in this Program EIR/EIS. The general HST corridors and study regions are shown in Figure 2.1-1.

2.6.1 Travel Times and Frequency of Service

Independent ridership and revenue forecasts (Charles River Associates) prepared for the Business Plan show that competitive travel times and frequent service are essential to attract travelers to an HST system. For the HST Alternative to be economically feasible, operating speeds over 200 mph (322 kph), high frequencies of service, and efficient operations are necessary. For this fundamental reason, the Authority and the FRA carried forward the criteria that the proposed HST system would operate at speeds of up to about 220 mph (350 kph) and developed a conceptual service plan (Section 2.6.2), that makes the HST system highly competitive with travel by air or auto. It is important to note that maximum speeds cannot be achieved on many portions of the proposed system, particularly the heavily constrained urban areas (Figure 2.6-1). Express travel between downtown San Francisco and downtown Los Angeles could be accomplished in just 2.5 hrs. The trip between downtown Los Angeles and San Diego would take a little over an hour. Table 2.6-1 shows additional samples of express travel times between cities.

Table 2.6-1
Express Travel Times

TRAVEL TIMES (HOURS:MINUTES)	Los Angeles	San Francisco	San Jose	San Diego	Sacramento	Fresno	Bakersfield	Riverside
Los Angeles	-	2:30	2:02	1:00	2:09	1:19	0:47	0:29
San Francisco	2:30	-	0:31	3:29	1:40	1:15	1:47	2:58
San Jose	2:02	0:31	-	3:00	1:12	0:46	1:18	2:29
San Diego	1:00	3:29	3:00	-	3:07	2:17	1:46	0:34
Sacramento	2:09	1:40	1:12	3:07	-	0:53	1:25	2:36
Fresno	1:19	1:15	0:46	2:17	0:53	-	0:35	1:46
Bakersfield	0:47	1:47	1:18	1:46	1:25	0:35	-	1:15
Riverside	0:29	2:58	2:29	0:34	2:36	1:46	1:15	-

The Business Plan described a representative system of corridors and stations, and used the system in developing ridership forecasts, cost estimates, an assessment of potential environmental impacts, performance characteristics, and funding scenarios. The representative system is referred to in the Business Plan as the "highest return on investment route" and is incorporated into the range of corridors being studied for the HST Alternative.[7] The ridership forecast for the highest return on investment route has been used as the *representative demand* for defining the intercity travel need for the HST and Modal Alternatives.

The projected HST travel times account for alignment, train performance characteristics, acceleration and deceleration capabilities, and passenger comfort criteria. HST system operators and manufacturers of HST equipment were consulted in the development of the travel times and design criteria for the proposed HST system.

2.6.2 Conceptual Service Plan

To satisfy the travel time, service quality, and ridership goals (representative demand) developed for the Business Plan, and accounting for the general characteristics of the corridors considered, a conceptual service plan was developed that would provide a wide variety of service options. A mix of express, semi-express, local, and regional trains would serve both intercity passengers and long-distance commuters. In order for HST service to be economically viable, the plan provides frequent and efficient operations.

In 2020, a total of 86 weekday trains in each direction would be provided to serve the statewide intercity travel market. Sixty-four of the trains would run between northern and southern California, and the remaining 22 trains would serve shorter distance markets. The basic service pattern provides most passenger service between 6 a.m. and 8 p.m., with a few trains starting or finishing trips beyond these hours. Eighty-six trains per day could be a highly frequent operation; however, as shown below, when divided into 5 levels of service the frequency is greatly reduced. Frequencies would be further reduced in order to serve multiple end points. For example, for HST service between northern and southern California through the Central Valley, some trains would go to the Bay Area, and others to Sacramento. Therefore, while there could be 12 local trains, only a portion of these would serve each endpoint. The following five types of intercity trains are planned.

- Express (20 trains per day): Trains running between Sacramento, San Jose, or San Francisco and Los Angeles or San Diego without intermediate stops.
- Semi-Express (12 trains per day): Trains running between Sacramento, San Jose, or San Francisco and Los Angeles and San Diego with intermediate stops at major Central Valley cities such as Modesto, Fresno, and Bakersfield.
- Suburban-Express (20 trains per day): Trains running between northern and southern California and locally within the major metropolitan areas (i.e., the San Francisco Bay Area and the Los Angeles area) at the beginning and end of the trip without intermediate stops in the Central Valley.
- Local (12 trains per day): Trains stopping at all stations. Some of these local trains might ultimately be operated as a "skip stop" or semi-express service, where trains would stop at only a portion of the possible stations on a specific line, to improve the service and better match patterns of demand.
- Regional (22 trains per day): Sacramento to San Francisco service and early morning service from the Central Valley to San Francisco or Los Angeles/San Diego.

[7] The route defined by the Business Plan is approximately 700 mi (1,127 km) long and serves the major metropolitan areas of California, including San Francisco, Sacramento, the Central Valley, Los Angeles, and San Diego.

2.6.2a Safety and Security

The safe operation of the HST system would be of the utmost importance. To this end, the HST Alternative is described as a fully grade separated and fully access-controlled guideway with intrusion monitoring systems. This means that the HST infrastructure (e.g., mainline tracks and maintenance and storage facilities) would be designed to prevent access by unauthorized vehicles, persons, animals, and objects. The capital cost estimates include allowances for appropriate barriers (fences and walls), state-of-the-art communication, access-control, and monitoring and detection systems. All aspects of the HST system would conform to the latest Federal requirements regarding transportation security as developed and implemented.

The HST trainsets (train cars) would be pressure sealed to maintain passenger comfort regardless of aerodynamic changes along the line. The description of the HST Alternative in the Final Program EIR/EIS has been updated to include this provision.

2.6.2b Electrification

Please see Section 3.5 Energy of the Program EIR/EIS, which provides an overview of the potential operation and construction impacts associated with the use of energy, including electrical energy, for the existing conditions and the No Project, Modal and HST Alternatives. The energy analysis concluded that the HST Alternative would have a net energy benefit as compared to the No Project Alternative, but would result in an increase in electric power demand. The Draft Program EIR/EIS assessed the total energy that would be needed from California's electricity grid to power and to operate the proposed HST system from its commencement (a portion of the system) to full implementation. The HST alternative does not include the construction of a separate power source. The analysis concluded that sufficient electricity is expected to be available to power the proposed HST, as segments are constructed and begin operating, since power generation is expected to grow to meet increased demand in the state and the power needs of the proposed HST system represent a small part of that overall increase in demand. It is beyond the scope of this Program EIR/EIS to analyze all the potential additions that may be made to the state's power general system to serve increased electricity demand in California over time.

For the purposes of identifying potential impacts and costs in the Draft Program EIR/EIS, the HST power supply system was defined in the Engineering Criteria report, which was included in the Draft Program EIR/EIS by reference. The power supply would consist of a 2x25KV overhead catenary system for all electrified portions of the statewide system. Supply stations would be required at approximately 30-mile intervals. Based on the estimated power needs of this system, these stations would need to be approximately 20,000 square feet (200' X 100'). Switching stations would be required at approximately 15-mile intervals. These stations would need to be approximately 7,500 square feet (150' X 50'). Paralleling (booster) stations would be required at approximately 71/2-mile intervals. These stations would need to be approximately 5,000 square feet (100' X 50'). Each station includes a control house that would need approximately 800 square feet (40' X 20'). These facilities are not sited as part of this Program EIR/EIS. However, the facilities defined fall well within the potentially affected environment areas defined for the Program level EIR/EIS study. Facility placement, sizing, and spacing would be determined during subsequent project level environmental review.

Appendix 4-C describes the unit costs and assumptions for electrification items (substations, cable trenches, electrical equipment, catenary poles, wires, power feeders and returns, transformers, etc.). Costs for the transmission lines from the local utility source to the substation are included in the energy costs, which are a part of the HST system operation and maintenance costs.

2.6.3 Potential for Freight Service

The proposed HST system could be used to carry small packages, parcels, letters, or any other freight that would not exceed typical passenger loads. This service could be provided either in specialized freight cars on passenger trains or on dedicated lightweight freight trains. In either case, the lightweight freight vehicles would be required to have the same performance characteristics as the passenger equipment. This type of freight could be accommodated without adjustment to the passenger operational plan or modification to the passenger stations and therefore was included in the funding scenario described in the Business Plan.

A high-speed freight service might also be provided on specialized, medium-weight freight trains. This specialized freight equipment would have limited axle loads (19 metric tons compared to the conventional freight standard of 27 metric tons per axle), would operate at speeds of up to 125 mph (200 kph), and would be scheduled at night to avoid conflict with passenger or maintenance operations. A medium-weight freight service could carry high-value or time-sensitive goods such as electronic equipment and perishable items. Although such a service would not interfere with passenger operations, it would require loading and unloading facilities separate from the passenger stations. Additional pick-up and distribution networks for this type of freight might also be required. While the Authority recognizes the potential for overnight medium-weight freight service on the proposed high-speed tracks, it has not been included in this analysis. Discussions with potential high-speed freight operators could be initiated as part of subsequent project development with appropriate analysis.

2.6.4 Performance Criteria

The Authority and the FRA defined performance criteria for the HST Alternative that would meet the purpose of and need for a proposed HST system, using information gathered in previous feasibility and corridor evaluation studies. To meet the travel time and service quality goals, the proposed statewide HST system would be capable of speeds in excess of 200 mph (320 kph) on fully grade-separated tracks with state-of-the-art safety, signaling, and automated train control systems. These performance criteria are summarized in Table 2.6-2.

Table 2.6-2
HST Performance Criteria

Category	Criteria
System Design Criteria[8]	Electric propulsion system. Fully grade-separated guideway. Fully access-controlled guideway with intrusion monitoring systems. Track geometry must maintain passenger comfort criteria (smoothness of ride, lateral acceleration less than 0.1 g).
System Capabilities	All-weather/all-season operation. Capable of sustained vertical gradient of 3.5% without considerable degradation in performance. Capable of operating parcel and special freight service as a secondary use. Capable of safe, comfortable, and efficient operation at speeds over 200 mph. Capable of maintaining operations at 3-minute headways. Capable of traveling from San Francisco to Los Angeles in approximately 2.5 hrs. Equipped with high-capacity and redundant communications systems capable of supporting fully automatic train control.
System Capacity	Fully dual track mainline with off-line station stopping tracks. Capable of accommodating a wide range of passenger demand (up to 26,000 passengers per hour per direction).

[8] Engineering Criteria, January 2004

Category	Criteria
	Capable of accommodating normal maintenance activities without disruption to daily operations.
Level of Service	Capable of accommodating a wide range of service types (express, semi-express/limited stop, and local).

2.6.5 Description of High-Speed Train Technology Groups

Four primary technology groups were considered in the development of the HST Alternative. Because of the need for early implementation, other less developed technologies (those not currently in operation or not ready for implementation) were not considered. The groups are classified by their speed (both currently obtainable speeds as well as targeted speeds that may result from further research and development) and by similar design characteristics. The four technologies—very high speed steel-wheel-on-steel-rail, magnetic levitation, high speed steel-wheel-on-steel-rail, and non-electrified steel-wheel-on-steel-rail—are described below.

A. VERY HIGH-SPEED STEEL-WHEEL-ON-STEEL-RAIL (ELECTRIFIED)

The very high-speed (VHS) group includes trains capable of maximum operating speeds near 220 mph (350 kph) using steel-wheel-on-steel-rail technology (Figure 2.6-2). To operate at high speeds, a dedicated, fully grade-separated right-of-way is necessary with more stringent alignment requirements than those needed for lower speed lines. However, it would be possible to integrate VHS systems into existing conventional rail lines in the congested urban areas with resolution of potential equipment and operating compatibility issues by the FRA and the California Public Utilities Commission. All VHS systems currently in operation use electric propulsion with overhead catenary. These include the Train à Grande Vitesse (TGV) in France, the Shinkansen in Japan, and the InterCity Express (ICE) in Germany.

B. MAGNETIC LEVITATION

The magnetic levitation (maglev) group uses either attractive or repulsive magnetic forces and electric propulsion to lift and move the train along a guideway (Figure 2.6-2). Current systems under development are designed for maximum operating speeds above that of VHS technology. The FRA's Maglev Deployment Program supports development of a system capable of operating speeds of 240 mph (385 kph) for the future implementation of a maglev demonstration project in this country. Magnetic levitation allows the vehicles to hover or float a short distance above the guideway, thereby eliminating friction and rolling resistance. Because of the unique dedicated guideway required, it would not be possible to share track with conventional steel wheel systems, although right-of-way could be shared.

C. HIGH-SPEED STEEL-WHEEL-ON-STEEL-RAIL

The high-speed (HS) group is basically an improvement of traditional railroad passenger technology that has been designed to operate at speeds of 100 to 150 mph (160 to 240 kph) on existing rail infrastructure. This category of technology includes "tilt" technology, which allows for higher operating speeds over geometrically constrained alignments (e.g., where a sharp curve radii restricts train speeds). Systems in this category use electric power sources. Amtrak's Acela service from Boston to New York City and to Washington, D.C., is an example of this technology.

D. NON-ELECTRIFIED STEEL-WHEEL-ON-STEEL-RAIL (CONVENTIONAL)

This technology group includes existing diesel locomotive intercity train equipment (e.g., Amtrak). Speeds of up to 100-150 mph (160 to 240 kph) are possible for this type of HST technology.

2.6.6 High-Speed Train Technology Options Considered and Rejected

A. STEEL-WHEEL-ON-STEEL-RAIL AT LOWER SPEED (BELOW 200 MPH)

The Authority's enabling legislation, Senate Bill (SB) 1420 (chaptered 9/24/96, Chapter 796, Statute of 1996), defines *high-speed rail* as "intercity passenger rail service that utilizes an alignment and technology that makes it capable of sustained speeds of 200 mph (320 kph) or greater."

Previously, the California Intercity High-Speed Rail Commission investigated three types of HST technology: HS, VHS, and maglev. The comparison of HS and VHS provided a basis for the recommended maximum speeds.

The lower ridership forecasts (based on the investment-grade analysis as described in Chapter 1) showed that sustaining high maximum operating speeds had a major impact on potential travel times and potential ridership and revenue for the system. The Commission's study showed that minimum express travel times between San Francisco and Los Angeles would be 3 hrs and 24 min for the HS technology, as compared to 2 hrs and 42 min for the VHS technology. Faster travel times afforded by the VHS technology would result in 3.7 million more riders and $151 million more annual revenue than the HS technology for the 2015 projections (Charles River Associates 1996). However, capital costs for the HS and VHS systems would be about the same. California's existing rail corridors have not been substantially improved, and shared use of the existing freight facilities was not considered feasible.[9] Both technologies would require the same fully grade-separated infrastructure that could not share tracks with standard U.S. freight operations, and both would require new alignments through mountain passes in both northern and southern California (Parsons Brinckerhoff 1995).

Based on this analysis, the Commission directed staff to focus the technical studies on the VHS and maglev technologies. This direction is consistent with foreign HST experience, the experience of the northeast corridor (Boston-New York-Washington, D.C.), and HST studies done elsewhere in the U.S., which show that to compete with air transportation and generate high ridership and revenue, the intercity HST travel times between the major transportation markets must be below 3 hrs.

B. MAGNETIC LEVITATION TECHNOLOGY AND STEEL-WHEEL-ON-STEEL-RAIL ELECTRIFIED, FULLY DEDICATED SERVICE

While a completely dedicated train technology using a separate track/guideway would be required on the majority of the proposed system, requiring such separation everywhere in the system would prohibit direct HST service to certain heavily constrained terminus sections (i.e., San Francisco Peninsula from San Jose to San Francisco, and the existing [LOSSAN] rail corridor between Los Angeles Union Station [LAUS] and Orange County). Because of extensive urban development and severely constrained right-of-way, HST service in these terminus sections would need to share physical infrastructure (tracks) with existing passenger rail services in existing or slightly modified corridors. Sharing track with existing passenger rail services on these heavily constrained corridors would allow for direct HST service without passenger transfer. However, the HST system would need to be compatible with the other trains sharing the tracks.[10] Maglev technology requires separate and distinct guideway configurations that would preclude the sharing of rail infrastructure.

[9] Current FRA safety requirements for rolling stock (trainsets) preclude the use of non-compliant rolling stock (such as off-the-shelf European equipment, which is constructed to different structural design standards) unless otherwise waived. In addition to the regulatory aspects, there are other issues associated with the potential operation of existing freight services with HST passenger services. High freight car axle loads and relatively low speed freight operations would compromise HST operating efficiency, maintenance standards/tolerances, and strict safety requirements. Conventional freight trains also require different track geometry for superelevation and have different clearance requirements.

[10] Current FRA safety requirements for rolling stock preclude the use of non-compliant rolling stock (such as off-the-shelf European equipment, which is constructed to different structural design standards) unless otherwise waived.

For example, on the San Francisco Peninsula, sharing track with Caltrain express services would be the only practical alternative for providing a direct link to San Francisco. Because of the lack of sufficient right-of-way along the Peninsula, dedicated (exclusive guideway) alignments would require tall elevated structures along Caltrain or U.S. Highway 101 (US-101) rights-of-way and extensive purchases of additional right-of-way. The aerial portions of such an alignment would introduce a major new infrastructure element along the Caltrain corridor that would have visual impacts (intrusion/shade/shadow) on the adjacent land uses, including residential areas along this alignment. For a Caltrain exclusive guideway alignment option, the introduction of an elevated structure (for the high-speed tracks and stations) would also have adverse impacts on the suburban town centers along the Caltrain corridor (San Mateo, San Carlos, Redwood City, Menlo Park, Palo Alto, and Mountain View). Although the structure would generally be in a commercial area in these centers, it would represent a physical barrier for land use and urban design. The installation of an exclusive guideway alignment would present major construction issues, involving the construction of an aerial guideway adjacent to and above active existing transportation facilities, while maintaining rail traffic. In San Francisco, major new tunnel construction, in addition to that already proposed for the extension of Caltrain services into the Transbay Terminal, would be required, and would similarly present major construction and cost issues.

In contrast, by taking advantage of the existing rail infrastructure, a shared-use configuration would be mostly at grade. Shared-use options would be less costly and would result in fewer environmental impacts. In addition, for these alignment options improved regional commuter service—electrified, fully grade-separated, with additional tracks and fencing—would help mitigate the impacts of additional rail service along the Peninsula. Shared-use improvements in this corridor would potentially result in safety and service improvements for Peninsula commuters and potentially improve automobile traffic flow at rail crossings and reduce noise impacts, since a grade-separated system could eliminate trains blowing warning horns throughout the alignment. Shared-use options would provide the opportunity for a partnership with the San Mateo County Transit District (SamTrans), the owner of the right-of-way, and operator of the Caltrain service, and would provide the opportunity to incrementally improve a portion of the network. While SamTrans has indicated support for the general concept of a proposed HST system sharing tracks with Caltrain service, it has also commented that a dedicated (exclusive guideway) high-speed rail service along its existing right-of-way would be infeasible, because there would not be enough space for both types of services to operate separately.

Improvements to these heavily constrained urban corridors would be most effectively implemented in an incremental manner to maintain existing services, allow for corresponding improvements to the existing services, limit construction impacts, and reduce immediate funding needs. By contrast, infrastructure for completely dedicated (separate track) steel-wheel-on-steel-rail or maglev technology would not lend itself to incremental improvement.

In summary, these two systems—maglev and steel-wheel-on-steel-rail electrified fully dedicated service—would not allow for direct HST service to major intercity travel markets and therefore would not meet the purpose of and need and objectives for the proposed project.

2.6.7 High-Speed Train Technology Option Carried Forward

STEEL-WHEEL-ON-STEEL-RAIL ELECTRIFIED, POTENTIAL FOR SHARED SERVICE

This type of HST technology includes steel-wheel-on-steel-rail trains capable of meeting the Authority's performance criteria (as summarized previously in Table 2.6-2) that would be able to share tracks at reduced speeds with other compatible services. All existing systems with this very high-speed capability use electric propulsion. This state-of-the-art, high-speed, steel-wheel-on-steel-rail technology would operate in the majority of the statewide system in dedicated (exclusive track) configuration. However, where the construction of new separate HST infrastructure would be infeasible, shared track operations would use improved rail infrastructure and electrical propulsion. Potential shared-use corridors would be limited to sections of the statewide system with extensive urban constraints. Shared-use corridors would meet the following general criteria in addition to the performance criteria.

- Uniform control/signal system.
- Four tracks at stations (to allow for through/express services and local stopping patterns).
- May require three to four mainline tracks (depending on capacity requirements of HST and other services).
- Physical or temporal separation from conventional freight traffic.

Using this technology, the proposed system would be constructed with consistent dual tracking in a variety of construction sections (e.g., at grade, elevated structure, tunnel), as appropriate for the constraints of each specific section. These typical construction sections are illustrated in Figures 2.6-3, 2.6-4, and 2.6-5.

2.6.8 Previously Considered Alternative Corridor Options Reconsidered and Rejected

The following HST Alternative corridor options were evaluated and eliminated from further consideration during the alternatives screening process based on the consideration of available information, primarily data from previous studies. The detailed technical results and descriptions of public involvement activities and findings that support the elimination of these conceptual alternatives are provided in previously completed reports referenced herein. These previous studies, as described above in Section 2.3.1 (*Background*), incorporated system objectives, analysis methods, and evaluation criteria similar to those used in this Program EIR/EIS. The previous studies applied GIS databases and analysis methods that have been refined, updated, and applied in this Program EIR/EIS.

Appendix 2-H provides tables summarizing the comparison of alternative HST corridors. These tables present screening criteria used to evaluate corridor options and distinguish between the options carried forward and those eliminated from further consideration. The tables highlight the primary considerations for elimination. Tables 2-H-2 and 2-H-3 in Appendix 2-H present some of the options evaluated in the previous studies. The reasons for elimination of each of the corridor options evaluated in the previous studies are categorically summarized below in Table 2.6-3 and further described in the subsections that follow.

Table 2.6-3
Review of Previous Studies of High-Speed Train Alternatives:
Corridor Options Considered but Eliminated

	Reason for Elimination						
Corridor	**Construction**	**Incompatibility**	**Right-of-Way**	**Connectivity/ Accessibility**	**Revenue/ Ridership**	**Environment**	**Environmental Concerns**
Los Angeles to San Francisco Bay only				P	P		
Coastal Corridor (San Jose to Los Angeles)	S				P	S	Natural resources along coast, cultural, visual, geology, property displacement

Corridor	Reason for Elimination: Construction	Incompatibility	Right-of-Way	Connectivity/ Accessibility	Revenue/ Ridership	Environment	Environmental Concerns
I-5 Corridor (Sacramento to Bakersfield)		S		P	P		
Capitol Rail Corridor (Sacramento to Oakland)				P	P		
Panoche Pass (Central Valley to Bay Area)	S			P	P		
LAX as LA Terminus	S			P	P		
LOSSAN Corridor dedicated high-speed service	P		P			P	Natural resources, coastal habitats and communities, wetlands/lagoons, visual, geology, biology
Extension to San Diego from East Mission Valley	P		P			P	Land use, property displacement
Peñasquitos Canyon (I-15 to I-5)						P	Natural resources, parkland, open space, wetlands preserve, biology

Definitions:

Reason: Primary (P) and Secondary (S) reasons for elimination.

Construction: Engineering and construction complexity, initial and/or recurring costs that would render the project impracticable and logistical constraints.

Environment: High potential for considerable impacts to natural resources, including waters, streams, floodplains, wetlands, and habitat of threatened or endangered species that would fail to meet project objectives.

Incompatibility: Incompatibility with current or planned local land use as defined in local plans that would fail to meet project objectives.

Right-of-Way: Lack of available rights-of-way or extensive right-of-way needs would result in high acquisition costs and/or delays that would render the project impracticable.

Connectivity/Accessibility: Limited connectivity with other transportation modes (aviation, highway and/or transit systems) would impair the service quality, could reduce ridership of the HST system, and would fail to meet the project purpose.

Ridership/Revenue: The corridor would result in longer trip times and/or have suboptimal operating characteristics and would have low ridership and revenue and would fail to meet the project purpose.

For many of the corridor options described below, impracticability[11] (cost, constructability issues, technical constraints, and right-of-way constraints) or inability to meet basic project objectives and purpose and need (ridership potential, connectivity and accessibility, compatibility with existing or planned development, and severe operational constraints) is the prominent elimination factor. Inability to avoid or substantially reduce environmental impacts and other environmental considerations are primary factors in the elimination of the Peñasquitos Canyon extension to San Diego from East Mission Valley option and the dedicated high-speed service option along the coast between Los Angeles and San Diego. Environmental considerations also contribute to the factors supporting the elimination of the coastal corridor between San Jose and Los Angeles.

[11] Impracticability constraints are listed under the Clean Water Act Section 404. For this document, options considered "impracticable" were also considered "infeasible" under CEQA guidelines.

A. LOS ANGELES TO SAN FRANCISCO BAY ONLY

The Commission's 1993 enabling legislation, Senate Concurrent Resolution 6 (SCR-6) states that "by the year 2020, high-speed ground transportation service [should] be operating between Sacramento, the San Francisco Bay Area, the Los Angeles area, the San Bernardino/Riverside area, Orange County, and San Diego." An HST system serving these metropolitan areas and the Central Valley would be available to well over 90% of the state's population. The Commission recommended that the initial HST system link California's major transportation markets, limiting the necessary feasibility studies to the markets defined by SCR-6.

The SCR-6 legislation further states that "a Los Angeles to San Francisco Bay Area High-Speed Corridor [should] be the first corridor developed." The Commission identified several alternatives for phasing a proposed statewide HST network, including Sacramento to the Bay Area or Los Angeles to San Diego, as the first phases of the system. While the Commission deferred phasing decisions to later stages of project development, it recommended ruling out consideration of a San Francisco Bay Area to Los Angeles system that would not include links to Sacramento and San Diego (California Intercity High Speed Rail Commission 1996). Capital costs would be increased by more than 40%, and operational and maintenance costs would be increased by more than 30% with the addition of links to Sacramento and San Diego. However, the addition of these markets would have a positive impact on the forecasted ridership and revenue for the system. A statewide network that would include Sacramento and San Diego would increase ridership by nearly 90% and revenues by 86%. As a result, the Commission recommended that the HST system encompass California's major metropolitan areas: Sacramento, the San Francisco Bay Area, Los Angeles, and San Diego. The Los Angeles to San Francisco Bay only option was eliminated from further consideration because it would not serve all the markets recommended by the Commission and it would have only slightly over one half of the ridership of a system that included these markets.

B. COASTAL CORRIDOR (SAN JOSE TO LOS ANGELES)

Phase 1 of the Commission's feasibility studies comprised an initial broad-scale review of major corridor alternatives between the San Francisco Bay Area and Los Angeles (the coastal, I-5 and SR-99 corridors) to identify those with the greatest potential for HST service (Figure 2.6-6). This initial review concluded that the coastal corridor had the least potential for HST service at maximum speeds exceeding 150 mph (240 kph). Coastal corridor travel times between Los Angeles and the San Francisco Bay Area would be considerably longer than either the SR-99 or I-5 corridors. Travel times for coastal corridor alignments ranged from 3 hrs and 25 min to 4 hrs and 30 min for non-stop express VHS service (very high-speed steel-wheel-on-steel-rail service with maximum speeds up to 217 mph or 350 kph) between San Francisco and Los Angeles. Travel times for the I-5 and SR-99 corridors ranged from 2 hrs and 23 min to 2 hrs and 47 min between San Francisco and Los Angeles.

The longer travel times for the coastal corridor alignments were due to challenging and sensitive geography, particularly along the coast between San Luis Obispo and Los Angeles, which resulted in a longer route. With considerably longer travel times, this corridor had ridership projections 24% to 46% below the shortest I-5 corridor option. The coastal corridor also had the highest projected capital costs due to environmental constraints and the length of the route. The coastal corridor costs were estimated to be about 22% higher than the I-5 corridor and 12% higher than the SR-99 corridor. The coastal corridor was found to have the highest potential impacts on cultural resources, visual impacts, property displacement, as well as the most steep slopes, but lower potential impacts on threatened and endangered species and water resources than some inland corridor options.[12]

[12] These findings were adopted by the Commission in May 1995 and the analysis was summarized in the Commission's "Definition and Ranking of Potential Alignments" report dated September 15, 1995.

Based on its comparison of the coastal, I-5, and SR-99 corridors, the Commission redirected the focus of study to the I-5 and SR-99 corridors. The Commission concluded that the coastal corridor would be more suitable for conventional rail service below 150 mph (240 kph) and "does not support travel times fast enough to capture a considerable share of the end-to-end market" (California Intercity High Speed Rail Commission 1996). The Commission noted that intermediate markets served by the coastal corridor are popular "tourist and recreation markets with sizable existing populations" that might be well served by a slower, relatively inexpensive conventional intercity rail service using incrementally improved existing rail infrastructure. These conclusions are consistent with input received from public agencies in the coastal corridor and with the policies of the Coast Rail Coordinating Council, whose member agencies include San Luis Obispo Council of Governments, Santa Barbara County Association of Governments, Ventura County Transportation Commission, and the Transportation Agency of Monterey County.

The coastal corridor is not a reasonable HST route because its challenging topography results in a longer and slower route with higher capital costs. This corridor also has a higher potential for environmental impacts than other options because of the sensitive natural and cultural resources and residential communities in the coastal hills and valleys. In addition, this corridor would not serve fast-growing Central Valley cities. The coastal corridor fails to meet the purpose and need and basic objectives of the project because it would not reduce travel times between major intercity travel markets in California. Therefore, it was dismissed from further consideration in this Program EIR/EIS.

C. INTERSTATE 5 CORRIDOR (SACRAMENTO TO BAKERSFIELD)

Review of the I-5 and SR-99 corridors showed that, although the SR-99 corridor options would be about 6% more costly than the I-5 corridor options, the SR-99 corridor would provide far better service to the growing Central Valley population, while offering fast, competitive service between the San Francisco Bay Area and Los Angeles metropolitan regions. The SR-99 corridor was found to have the highest overall ridership potential, with ridership projections estimated at 1.2 million more annual passengers than the highest I-5 corridor projections (Charles River Associates 1996).

The I-5 corridor has very little existing or projected population between the San Francisco Bay Area and Los Angeles. In contrast, according to the California Department of Finance, well over 3 million residents are projected to live between Fresno and Bakersfield along the SR-99 corridor by 2015, which directly serves all the major Central Valley cities (Charles River Associates 1996). Residents along the SR-99 corridor lack a competitive transportation alternative to the automobile, and the Commission's detailed ridership analysis showed that they would be ideal candidates to use an HST system. The I-5 corridor would not be compatible with current land use planning in the Central Valley that accommodates growth in the communities along the SR-99 corridor.

Express trains in the SR-99 corridor would connect San Francisco to Fresno in just 1 hr and 15 min, and Fresno to Los Angeles in 1 hr and 20 min. This corridor would link San Francisco to Bakersfield in about 1 hr and 50 min, and Bakersfield to Los Angeles in less than 50 min. The SR-99 corridor was estimated to have 3.3 million more intermediate-market ridership (passengers to or from the Central Valley) per year than the highest I-5 corridor projections. Therefore, while SR-99 corridor travel times would be 11 to 16 min longer than the I-5 alternatives between Los Angeles and San Francisco, overall ridership and revenue for the SR-99 corridor would be higher.

The Commission considered linking the I-5 corridor to Fresno and Bakersfield with spur lines but rejected this concept since it would add approximately $2 billion to the I-5 corridor capital costs, provide less ridership than the SR-99 corridor, and create severe operational constraints (California Intercity High Speed Rail Commission 1996).

Preliminary environmental analyses concluded that there would be a number of constraints and potential impacts for both the I-5 and SR-99 corridors. These environmental constraints analyses did not identify clear differentiating factors between the two alternatives. The I-5 corridor was found to have a higher potential for impacts on the natural environment and land use, while the SR-99 corridor had a higher potential for social/cultural impacts (Parsons Brinckerhoff 1995).

At Commission meetings and through public workshops and other public involvement activities, the Commission found that the majority of public comments indicated a preference for the SR-99 corridor over the I-5 corridor. In particular, there was overwhelming support for the SR-99 corridor in the Central Valley. The Commission received resolutions of support for the SR-99 corridor from nearly every Central Valley city, county, and regional government (California Intercity High Speed Rail Commission 1996a and 1996b). At its February 1996 meeting, the Commission directed staff to focus further technical investigations on SR-99 corridor alternatives.

In summary, while the I-5 corridor could provide better end-to-end travel times compared to the SR-99 corridor, the I-5 corridor would result in lower ridership and would not meet the current and future intercity travel demand of Central Valley communities as well as the SR-99 corridor. The I-5 corridor would not provide transit and airport connections in this area, and thus failed to meet the purpose and need and basic objectives of maximizing intermodal transportation opportunities and improving the intercity travel experience in the Central Valley area of California as well as the SR-99 corridor. For these reasons the I-5 corridor was dismissed from further consideration in this Program EIR/EIS.

D. CAPITOL RAIL CORRIDOR (SACRAMENTO TO OAKLAND)

The Commission considered the capitol corridor (which approximates the I-80 corridor) to link the statewide HST system to Sacramento via the San Francisco Bay Area. However, the Commission recommended that further study of the connection to Sacramento should focus on the extension of the SR-99 corridor through the Central Valley rather than the capitol corridor (see Figure 2.6-7).

The capitol corridor is an existing intercity rail alignment carrying freight traffic, long-distance Amtrak, and intrastate service to and from the state capitol (Sacramento). This corridor is severely constrained by adjacent land use, topography, and its circuitous routing along and across San Pablo Bay from Benicia to Richmond. Moreover, speeds are restricted primarily because of curves through the heavily urbanized Bay Area metropolitan region from Benicia through Santa Clara County. In contrast, maximum speeds can be achieved throughout the SR-99 corridor south of the Sacramento metropolitan area. A trip from Sacramento to Los Angeles via the capitol corridor would be approximately 1.5 hrs longer than a Sacramento to Los Angeles trip via the SR-99 corridor. As a result, the statewide ridership using SR-99 to Sacramento would be about 1 million more passengers annually than that using the capitol corridor (California Intercity High Speed Rail Commission 1996).

Travel times between Sacramento and Oakland would be shorter via the capitol corridor than via the SR-99 corridor. Because of the high average speeds maintained through the Central Valley, however, the travel times between Sacramento and San Jose would be shorter via the SR-99 corridor.

In 2002, the capitol corridor rail service was the fastest-growing Amtrak service in the nation. The service is expected to continue to improve and expand operations. The Commission recommended that the existing capitol corridor intercity rail service be improved to speeds of up to 110 mph (177 kph), and that it serve (at least initially) as a feeder system to the statewide HST system. A direct HST link from Sacramento to Oakland via the capitol corridor is not included as part of the proposed HST system for the Program EIR/EIS. It could be considered in the future as a potential extension of the proposed HST system, if it is implemented.

In summary, HST service to Sacramento would be an integral part of the proposed action to construct an HST system considered in this Program EIR/EIS. However, the capitol corridor option for providing HST service to Sacramento was eliminated from further consideration in this Program EIR/EIS because it would not meet current and future intercity travel demand, would not sufficiently reduce intercity travel times between Sacramento and both the Bay Area and southern California, and thus would not meet the purpose and need and basic project objectives. In contrast, routes through the Central Valley satisfy the purpose of improving intercity travel between major metropolitan areas of California.

E. PANOCHE PASS (CENTRAL VALLEY TO BAY AREA)

The Commission investigated the Panoche Pass in its feasibility studies that were completed at the end of 1996). The proposed Panoche Pass crossing is forecasted to result in low ridership and revenue and would require higher capital and operating and maintenance costs between the San Francisco Bay Area and Los Angeles than other potential routes. More importantly, the Panoche Pass would not provide adequate service between the San Francisco Bay Area and Sacramento/Northern San Joaquin Valley.

For the San Francisco to Los Angeles route section, a Panoche Pass alignment was estimated to cost $500 million more than a Pacheco Pass alignment. Although there would be less tunneling and cut-and-fill compared to the Pacheco Pass, the Panoche Pass option would have to cross a much longer distance of mountainous terrain. The Pacheco Pass option would have higher intercity ridership for the San Francisco to Los Angeles section (300,000 passengers annually by 2015) than the Panoche Pass option because it would serve a greater portion of the Central Valley population and would provide slightly faster travel times between the major markets (California Intercity High Speed Rail Commission 1996).

The Pacheco Pass would provide a superior link to Sacramento and the northern San Joaquin Valley since it is 35 to 40 mi (56 to 64 km) north of the Panoche Pass. Ridership for the Pacheco Pass would be much higher than the Panoche Pass since trips from Sacramento/northern San Joaquin Valley to the Bay Area would take substantially longer via the Panoche Pass. For example, compared to the Pacheco Pass, the express trip time between Sacramento and San Jose was estimated to be 37 min longer using the Panoche Pass. Costs would also be substantially higher since the network (in total) would be more than 30 mi (48 km) longer using the Panoche Pass.

Like the capitol corridor, the Panoche Pass was eliminated from further consideration in this Program EIR/EIS because it would not meet current and future intercity travel demand and would not sufficiently reduce intercity travel times between Sacramento, as well as other northern San Joaquin Valley cities (Merced, Modesto, Stockton), and the Bay Area, and thus would not meet the purpose and need and basic program objectives. The Panoche Pass option also would be more costly and less efficient than other potential routes.

F. THIS SECTION LEFT BLANK INTENTIONALLY – due to revisions made in response to comments received, an Alternative Pass alignment will be considered in a subsequent study of the Northern Mountain Crossing.

G. LOS ANGELES INTERNATIONAL AIRPORT (LAX) AS LOS ANGELES TERMINUS STATION

The Phase 2 analyses of the Commission's feasibility studies indicated that a southern terminus at LAX failed to meet the purpose and need and basic project objectives (see Figure 2.6-11). A southern terminus at LAX is forecasted to result in low ridership and revenues and would not accommodate extensions to San Diego, Orange County, or Inland Empire (Riverside and San Bernardino Counties). It also would require high capital and operating and maintenance costs.

Ridership for the LAUS option would be more than 1 million passengers a year greater than the LAX terminus option (Charles River Associates 1995). The capital costs to develop and access a terminal at LAX along I-405 would be 116% greater than the LAUS terminal option using the Metrolink rail alignment. Construction on the I-405 alignment would be particularly costly because of a lack of any available right-of-way. In addition, the longer LAX option was estimated to have 12% greater operational and maintenance costs (California Intercity High Speed Rail Commission 1996). The LAUS and LAX options were projected to have similar environmental impacts.

Located in downtown Los Angeles, LAUS is the transit hub of the Los Angeles Metropolitan Area, serving buses, urban rail services, and intercity rail. Although LAX is the most heavily used airport in California and the hub airport for southern California, it is located away from downtown and is not as well connected to the Los Angeles transit network. Extensions of the HST system to Orange County, Inland Empire, and San Diego would be easier from the more centrally located LAUS and could be accomplished using existing rail alignments. An extension south from LAX to Orange County would need to use the heavily constrained I-405 alignment.

The Commission concluded that LAX would be inefficient and too costly as a Los Angeles terminus location, and recommended instead that service to a potential LAX station should be considered as an extension from downtown Los Angeles, e.g., from LAUS. While locating the Los Angeles terminus station at LAX instead of LAUS would serve some air travelers well, it would fail to maximize intermodal connections to the multimodal transit system in this area. Because the LAX terminus did not meet the purpose of and need for the proposed improvements, the Authority dismissed the LAX terminus from further consideration in this Program EIR/EIS. The elimination of this option would not preclude consideration in the future of a potential HST extension serving LAX with a spur line from LAUS.

H. LOS ANGELES-ORANGE COUNTY-SAN DIEGO (LOSSAN) CORRIDOR DEDICATED HIGH-SPEED SERVICE

The Commission investigated a dedicated HST system using the LOSSAN rail corridor. It concluded that a dedicated HST corridor with completely separate tracks for HST service would be impracticable in the severely constrained LOSSAN corridor because of severe constructability issues and high costs. The corridor would also have considerable environmental impacts.

In 2002, the existing LOSSAN rail corridor was the second-most-traveled rail passenger route in the U.S. In addition to Amtrak's intercity service, two thriving commuter rail services (Metrolink and Coaster) operate in this corridor, along with considerable rail freight traffic. Although the corridor provides the most direct rail route between Los Angeles and San Diego, it passes through some of the state's most populated regions and environmentally sensitive areas (wetlands, coastal lagoons, fragile coastal bluffs, and coastal communities).

The Commission's technical investigations and public input throughout the feasibility studies identified considerable environmental obstacles to implementing a dedicated HST service along the LOSSAN corridor. Written comments received during the Commission's public comment period raised the following issues.

- The coastal bluffs are narrow in some areas and susceptible to failure, in particular the Del Mar Bluffs. Noise and vibration from steel-wheel-on-steel-rail traffic could result in harm to the fragile bluffs above the beach.
- The existing right-of-way is narrow and currently divides Encinitas. Additional service in the corridor could restrict access and enjoyment of the beach area for visitors and residents.

- To prevent dangerous pedestrian crossings of the tracks, the railroad rights-of-way would need to be fenced. This would restrict or block beach access and concentrate the crossing of pedestrian and vehicle traffic at fewer locations.
- Noise and vibration from trains would be disruptive to ecologically sensitive coastal areas and lagoons (e.g., San Elijo Lagoon). The saltwater marshes and lagoons are a winter habitat to residential avian species protected under state and federal laws.
- A dedicated right-of-way would require two more tracks at grade (with fencing) or a double-deck configuration, to accommodate existing rail services and high-speed rail. In Encinitas, there may not be room in the existing right-of-way to add two more tracks at grade, so this could mean a double-deck configuration. The structures and overhead catenaries could block highly sensitive ocean and community views, creating a negative aesthetic impact on tourism-related businesses and potentially reducing property values adjacent to the corridor.

After reviewing the work of the Commission, recent technical reports, and comment received during scoping and in the screening process, the Authority and the FRA determined to study an upgraded LOSSAN corridor to provide higher operating speeds but rejected a dedicated high-speed system for this area. The high level of existing passenger rail, extensive existing rail infrastructure, and mixed rail traffic operations on this corridor, along with the limited existing right-of-way and sensitive coastal resources, make a dedicated electrified HST service infeasible for this corridor at this time. Incremental improvement phasing, however, would be feasible. For this option, improvements would be made to the existing LOSSAN rail corridor and rail service to improve this service as a link to the HST corridor in Los Angeles. These improvements could be applied with or without the implementation of an inland (I-15) corridor (California High Speed Rail Authority 1999).

I. EXTENSION TO DOWNTOWN SAN DIEGO FROM EAST MISSION VALLEY (QUALCOMM STADIUM)

Several alignment options were considered in the Commission's studies to access downtown San Diego from the I-15 corridor. One of these options would have traversed Mission Valley between I-15 and I-5 prior to joining the existing LOSSAN rail corridor and proceeding south to downtown San Diego (Figure 2.6-12). The Commission's technical studies showed that, because of extensive urban development of land uses and existing transportation systems, there would be insufficient space for a new HST corridor without extensive displacement and disruption to the existing communities. The high concentration of existing transportation facilities in Mission Valley (I-8, I-805, SR-163, and numerous arterial streets) presented constraints both horizontally and vertically due to multilevel crossings and interchanges. Existing urban development (mostly commercial and high-density residential) left no space for an HST alignment. Consultation with local and regional agencies confirmed the constraints on the proposed alignment option and its incompatibility with existing land uses.

The use of the Mission Valley to cross over from the I-15 corridor to the I-5 corridor was dismissed by the Authority from further consideration in this Program EIR/EIS because this option was impracticable as a result of high costs and constructability issues and would require displacement of residences that could be avoided with the use of other routes to reach downtown San Diego. A modification of this corridor option, which included a deep bore tunnel, was considered and was also rejected as impracticable in a subsequent screening evaluation.

J. PEÑASQUITOS CANYON (I-15 TO I-5)

Another alignment option considered to access downtown San Diego from the I-15 corridor traversed Peñasquitos Canyon between I-15 and I-5 prior to joining the existing LOSSAN rail corridor and proceeding south to downtown San Diego (Figure 2.6-12). The Peñasquitos Canyon crossing was eliminated from further consideration in this Program EIR/EIS because of its inability to avoid or to substantially reduce potential environmental impacts. Over half of the alignment option would have traversed the Peñasquitos Canyon Preserve, an area of open space preserved by the County of San Diego. In addition to the obvious parkland impacts, the alignment option also presented extensive potential impacts on wetland areas, water resources, and sensitive biological habitats, as well as on the viewsheds in the area of the preserve.

2.6.9 Alternative Alignment and Station Options Considered in Screening Evaluation

The Authority and the FRA developed a range of potential HST Alternative alignment and station options through review of previous studies discussed in Section 2.1.1, review of scoping comments, and engineering evaluation of alignment and station options within the most promising potential corridors. Through the screening process, alignment and station options were identified that best met the purpose and need of the proposed action. At the conclusion of the screening process, certain alignment and station options were determined to be reasonable and feasible and are analyzed in this Program EIR/EIS.

To facilitate analysis, the proposed statewide HST system was divided into five regions, and technical evaluations of the available options in each region were prepared. The alignment and station options within HST Alternative corridors carried forward are illustrated in Figures 2.6-13 and 2.6-14 for the northern and southern portions of the study area, respectively. These options are defined and described in detail in the screening report and the regional alignment/station screening evaluation reports (California High Speed Rail Authority 2001). The screening evaluation included the following activities.

- Review of past alignment and station options identified in previous studies within viable corridors.
- Identification of alignment and station options not previously evaluated.
- Evaluation of alignment and station options using standardized engineering, environmental, and financial criteria and evaluation methodologies.
- Evaluation of alignment and station options against defined objectives.

The alignment and station-screening evaluation reports were combined with public and agency input, and provided the Authority and the FRA with the necessary information to identify a reasonable range of alignment, station location, and HST corridor options. The evaluation of potential HST alignments and stations within viable corridors used the following standardized criteria.

- Construction: Substantial engineering and construction complexity as well as excessive initial and/or recurring costs were considered criteria for project impracticability because they present logistical constraints.
- Environment: A high potential for considerable impacts to natural resources including waters, streams, floodplains, wetlands, and habitat of threatened or endangered species was considered a criterion for failing to meet project objectives.
- Land Use Compatibility: Substantial incompatibility with current or planned local land use as defined in local plans was considered a criterion for failing to meet project objectives.
- Right-of-Way: A lack of available right-of-way or extensive right-of-way needs that would result in excessively high acquisition costs for a corridor, technology, alignment, or station were considered criteria for project impracticability.
- Connectivity/Accessibility: Limited connectivity with other transportation modes (aviation, highway and/or transit systems) that would impair the service quality and could reduce ridership of the HST system was considered a criterion for failing to satisfy the project purpose.
- Ridership/Revenue: Longer trip times and/or suboptimal operating characteristics that would result in low ridership and revenue were considered criteria for failing to satisfy the project purpose.

Table 2.6-5 presents the relationship of objectives and criteria applied in the screening evaluation. The objectives and criteria used in this evaluation represent further refinement of those used in previous studies and incorporated the HST system performance goals and criteria described in Section 2.1. Alignment and station options were considered and compared based on the established objectives and criteria.

Table 2.6-5
High-Speed Rail Alignment and Station Evaluation Objectives and Criteria

Objective	Criteria
Maximize ridership/revenue potential	Travel time Length Population/employment catchment area
Maximize connectivity and accessibility	Intermodal connections
Minimize operating and capital costs	Length Operational issues Construction issues Capital cost Right-of-way issues/cost
Maximize compatibility with existing and planned development	Land use compatibility and conflicts Visual quality impacts
Minimize impacts on natural resources	Water resources impacts Floodplain impacts Wetland impacts Threatened and endangered species impacts
Minimize impacts on social and economic resources	Environmental justice impacts (demographics) Farmland impacts
Minimize impacts on cultural and parks/wildlife refuge resources	Cultural resources impacts Parks and recreation impacts Wildlife refuge impacts
Maximize avoidance of areas with geologic and soils constraints	Soils/slope constraints Seismic constraints
Maximize avoidance of areas with potential hazardous materials	Hazardous materials/waste constraints

The screening evaluation criteria focus on cost and travel time as primary indicators of engineering viability and ridership potential. Capital costs were estimated and travel times were quantified for each alignment and station option considered. Other engineering criteria such as operational, construction, and right-of-way issues were evaluated qualitatively. The screening evaluation criteria are consistent with the criteria applied in the previous studies. The criteria related to HST operations are based on accepted engineering practices, the criteria and experiences of other railway and HST systems, and the comments of HST manufacturers.

The broad objectives and criteria related to the environment used for evaluation reflect the objectives of NEPA and CEQA, and are consistent with the objective of the Clean Water Act Section 404(b)(1) to provide consideration of alternatives to minimize impacts on waters of the U.S. The environmental constraints and impacts criteria focus on environmental issues that can affect the location or selection of alignments and stations.

To identify potential impacts, a number of commonly available GIS digital data sources were used along with published information from federal, state, regional, and local planning documents and reports. Alignment and station rights-of-way widths dictated by engineering requirements were used to identify, in general terms, the sensitive environmental resources within each corridor segment. For screening potential environmental impacts were reviewed by considering areas of potential impact appropriate to the resources, and these areas varied from 100 ft (30 meters [m]) to 0.5 mi (0.8 km), extending beyond the conceptual right-of-way for the segments. In some cases, field reconnaissance was required to view on-the-ground conditions and to provide relative values.

The results of the detailed screening evaluation are described in the *California High-Speed Train Screening Report* (California High Speed Rail Authority 2001), which was presented at public meetings of the Authority governing board in August 2001 through January 2002. Some alignment and station options were considered and removed from further study. For most of the alignment and station options not carried forward, failure to meet the general project purpose and objectives and practicability constraints were the primary reasons for elimination. Environmental criteria were considered a reason for elimination when an option had considerably more probable environmental impacts than other practicable options for the same segment. General project purpose and objectives were considered in terms of ridership potential, connectivity and accessibility, incompatibility with existing or planned development, and severe operational constraints. Practicability constraints were considered in terms of cost, constructability, right-of-way constraints, and other technical issues. To assess the constructability of tunnels, some specific thresholds were established to help guide the ranking. Continuous tunnel lengths of more than 12 mi were considered impracticable, and the crossing of major fault zones at grade was also identified as a necessary criterion. For other practicability considerations (e.g., right-of-way constraints, construction issues, costs) thresholds could not be established for this program-level evaluation and impracticability was determined based on professional judgment. Environmental constraints are identified for alternatives only if they constituted primary reasons for eliminating an alternative. The remaining alignment and station options within each region were determined to generally meet the objectives described in the purpose and need and are analyzed in this Program EIR/EIS.

Tables summarizing the comparison of alignment and station options prepared during the screening evaluation are included in Appendix 2-H. As discussed in the previous section, these tables present screening criteria used to evaluate all alignment and station options considered and distinguish between the options carried forward and those eliminated from further consideration. The primary considerations for elimination are highlighted. The tables in Appendix 2-H include information from the tunneling conference and the alignments that were developed as part of the Quantm optimization study, which was used for the screening of alignments and station locations for the Bay Area to Merced and Bakersfield to Los Angeles regions. The specific methodologies applied in the screening evaluation and a summary of the criteria and measurements used are presented by region in Appendix 2-I.

Proposed HST alignment options are generally configured along or adjacent to existing rail transportation facilities instead of creating new transportation corridors. While a wide range of options have been considered, the Authority's initial conceptual approach, previous corridor evaluations, and the screening evaluation conducted as part of this Program EIR/EIS have consistently shown a potential for fewer substantial environmental impacts along existing highway and rail facilities than on new alignments through both developed and undeveloped areas. Although increasing the overall width of existing facilities could have similar potential impact on the amount of land disturbed as creating new facilities, creating new facilities would also introduce potential incompatibility and severance issues in both urban communities and rural settings (farmlands, open spaces).

The station locations described in this section were identified generally and represent the most likely sites based on current knowledge, consistent with the objective to serve the state's major population centers. There is a critical tradeoff between accessibility of the system to potential passengers and the resulting HST travel times (i.e., more closely spaced stations will lengthen the travel times for local service as well as express services). The station locations shown here are spaced approximately 50 mi (80 km) apart in rural areas and 15 mi (24 km) apart in the metropolitan areas. Additional or more closely spaced stations would negatively impact travel times and the ability to operate both express and local services.

Several key factors were considered in identifying potential station stops, including speed, cost, local access times, potential connections with other modes of transportation, ridership potential, and the distribution of population and major destinations along the route. Again, the ultimate locations and configurations of stations cannot be determined until the project-level environmental process. The alignment and station options are described by region below.

A. BAY AREA TO MERCED

This region includes central California from the San Francisco Bay Area (San Francisco and Oakland) south to the Santa Clara Valley and east across the Diablo Range to the Central Valley. To facilitate this analysis, this region was divided into three sections.

- San Francisco to San Jose.
- Oakland to San Jose.
- San Jose to Merced.

These sections are fundamentally different and distinct in terms of land use, terrain, and construction configuration (mix of at-grade, aerial structure, and tunnel sections). The alignment and station options considered in each section of the Bay Area to Merced region are discussed below and compared in detail in Appendix 2-H.

Bay Area to Merced Options Eliminated

Figure 2.6-15 shows the alignments and stations that were considered and eliminated for the Bay Area to Merced region. The reasons for elimination of the options are categorically summarized in Table 2.6-6 and further described in the following subsections.

Table 2.6-6
Bay Area to Merced: High-Speed Train Alternative Alignment and Station Options Considered and Eliminated

Alignment or Station	Reason for Elimination							Environmental Concerns
	Construction	Incompatibility	Right-of-Way	Connectivity/ Accessibility	Revenue/ Ridership	Alignment Eliminated*	Environment	
San Francisco to San Jose								
US-101 Alignment (exclusive guideway)	P	S	P				P	Visual, land use (right-of-way acquisition)
Caltrain Corridor (exclusive guideway)	P	P	P				P	Visual, land use (right-of-way acquisition), cultural resources
Station Locations								
Millbrae–San Francisco Airport (US-101)						P		
Redwood City (US-101)						P		
Oakland to San Jose								
Mulford Line (Note: only Oakland to Newark portion to be eliminated)	P	P	P				S	Visual, land use
I-880 (Note: only Oakland to Fremont portion to be eliminated)	P		P					
Former Western Pacific Railroad (WPRR) Rail Line to Hayward Line to I-880 (WPRR alignment/Hayward/I-880)	P							
Former WPRR Rail Line through Niles Junction to Mulford Line (WPRR/Niles/Mulford alignment)	P							
Hayward Line via tunnel to Mulford Line (Hayward/Tunnel/Mulford alignment)	P	S	P				S	Land use, seismic constraints
Former WPRR Rail Line via tunnel to Mulford Line (WPRR/Tunnel/Mulford alignment)	P	S	P				S	Land use, seismic constraints
Station Locations								
Lake Merritt		P		P				
Jack London Square	P			P				
I-880 Hegenberger						P		
Coliseum BART (WPRR)						P		
Fremont–Warm Springs	P							
Mowry Avenue	P					P		
San Jose to Merced								
Merced Southern alignment (Central Valley Portion of San Jose-Merced section for Diablo Range Direct options)							P	San Luis National Wildlife Refuge impacts
Direct Tunnel Alignment (Northern or Southern Connection to Merced	P						S	Seismic constraints

Alignment or Station	Construction	Incompatibility	Right-of-Way	Connectivity/ Accessibility	Revenue/ Ridership	Alignment Eliminated*	Environment	Environmental Concerns
	Reason for Elimination							
Caltrain/Morgan Hill/Foothill/Pacheco Pass Alignment	P	P		P			P	Visual, land use
Caltrain/Morgan Hill/East US-101/Pacheco Pass Alignment		P		P				
Station Locations								
Morgan Hill (Foothills)				P		P		
Morgan Hill (East of US-101)				P		P		
BART = San Francisco Bay Area Rapid Transit District.								
Definitions:								
Reason: Primary (P) and secondary (S) reasons for elimination.								
Construction: Engineering and construction complexity, initial and/or recurring costs that would render the project impracticable and logistical constraints.								
Environment: High potential for considerable impacts to natural resources, including waters, streams, floodplains, wetlands, and habitat of threatened or endangered species that would fail to meet project objectives.								
Incompatibility: Incompatibility with current or planned local land use as defined in local plans that would fail to meet project objectives.								
Right-of-Way: Lack of available rights-of-way or extensive right-of-way needs would result in high acquisition costs and/or delays that would render the project impracticable.								
Connectivity/Accessibility: Limited connectivity with other transportation modes (aviation, highway and/or transit systems) would impair the service quality, could reduce ridership of the HST system, and would fail to meet the project purpose.								
Ridership/Revenue: The alignment/station would result in longer trip times and/or have suboptimal operating characteristics and would have low ridership and revenue and would fail to meet the project purpose.								
Alignment Eliminated: Station or connection eliminated because the connecting alignment option was eliminated.								
* Alignment Eliminated column only applies to station locations. If an alignment is eliminated, a specific station location may no longer be necessary.								

San Francisco to San Jose: The alignment and station options eliminated from further consideration in this segment are illustrated in Figure 2.6-16 and described below.

- US-101 Alignment (Exclusive Guideway): From San Francisco (Transbay Terminal or 4th and King Terminal Station), this alignment would follow south along the US-101 freeway alignment to San Jose and be on an exclusive guideway in the US-101 corridor.

  This exclusive guideway alignment would have major construction issues involving the construction of an aerial guideway adjacent to and above an active existing freeway facility while maintaining freeway traffic. Limited right-of-way in this corridor would require the extensive purchase of additional right-of-way and nearly exclusive use of an aerial structure between San Francisco and San Jose. In San Francisco, major new tunnel construction would be required.

The US-101 alignment would require many sections of high-level structures to pass over existing overpasses and connector ramps, resulting in high construction costs and constructability issues that would make this option impracticable. This alignment would also require relocating and maintaining freeway access and capacity during construction. The aerial portions would introduce a major new visual element along the US-101 corridor that would have visual impacts (intrusion/shade/shadow) on the residential portions for this alignment. In addition, the freeway has substandard features (e.g., medians and shoulders) in many places, and it is assumed that any room that might be available for HST facilities likely would be used by Caltrans to upgrade the freeway in these areas. Construction of the tunnel in San Francisco from the Transbay Terminal site to 17th Street would be difficult because most of the tunnel would need to be constructed using compressed air techniques in very soft Bay-fill ground.

- <u>Caltrain Corridor (Exclusive Guideway)</u>: From San Francisco (Transbay Terminal or 4th and King Terminal Station), this alignment would follow south along the Caltrain rail alignment to San Jose. This alignment would be on an exclusive guideway within the Caltrain corridor.

  An exclusive guideway alignment would be impracticable in this area because it would have major construction issues and high capital costs involving the construction of an aerial guideway adjacent to and above an active existing transportation facility, while maintaining rail traffic. It would require the extensive purchase of additional right-of-way and nearly exclusive use of an aerial structure between San Francisco and San Jose.

  The aerial portions of this alignment would introduce a new visual element along the Caltrain corridor that would have visual impacts (intrusion/shade/shadow) on the residential portions of this alignment. For the Caltrain exclusive guideway option, introduction of the elevated structure (for the high-speed tracks and stations) would also have adverse impacts on the suburban town centers along the Caltrain corridor (San Mateo, San Carlos, Redwood City, Menlo Park, Palo Alto, and Mountain View). Although the structure would generally be in a commercial area in these centers, it would represent a physical barrier for land use and urban design. Construction of the tunnel in San Francisco from the Transbay Terminal site to 17th Street would be particularly difficult because most of the tunnel would need to be constructed using compressed air techniques in very soft Bay-fill ground. Although the Caltrain exclusive guideway alignment would provide faster potential travel times than any of the other alignment options in this section, this alternative would have the most impacts on cultural resources and would be the least compatible with the existing and planned development on the Peninsula. Samtrans has formally commented that this alternative would not be compatible with its existing and planned Caltrain services and would not be feasible in its existing right-of-way.

<u>Station Locations</u>: The following station locations were considered and eliminated because they were located on alignments that were eliminated.

- Millbrae–San Francisco International Airport (US-101).
- Redwood City (US-101).

<u>Oakland to San Jose</u>: The alignment and station options eliminated from further consideration in this segment are illustrated in Figure 2.6-17 and described below.

- Mulford Line: From Oakland, this alignment would follow south along Union Pacific Railroad's (UPRR's) entire Mulford Line.[13]

  Using the most northern portion of the Mulford Line would be impracticable, having high capital costs and construction issues, because it is an existing narrow rail line whose use would need to be expanded to accommodate a proposed HST system. It would create substantial environmental impacts and have considerable potential for effects on social and economic resources and minority populations while being the least compatible with existing and planned development. This alignment would require a portion of the UPRR corridor (that is generally 60 ft or 18.3 km wide) for aerial structure foundations and for an aerial easement over the tracks that would result in high visual impacts. In addition, a 50-ft (15.3-km) right-of-way strip would be needed from the residential, commercial, and light industrial areas to the east of the alignment.

- I-880: From Oakland, this alignment would follow I-880 south to San Jose.[14]

  The I-880 alignment would require acquisition of considerable right-of-way in the more northern area to be able to expand the highway sufficiently to allow for high-speed tracks in the median. The I-880 alignment would be mostly an aerial configuration requiring construction of footings within the highway right-of-way and lane closures during construction. This likely would require off-peak construction, which is time consuming and costly. Where the highway is narrow (Oakland to Fremont), adding high-speed rail would require full median widening and would present right-of-way issues similar to major highway reconstruction (demolition of existing adjacent property, new noise walls, demolition of existing noise walls, construction of new highway lanes, and maintenance of traffic). This alternative would have high capital costs and substantial right-of-way constraints, making it impracticable.

- Former Western Pacific Railroad (WPRR) Rail Line to Hayward Line to I-880 (WPRR alignment/Hayward/I-880): From Oakland, this alignment would follow the UPRR (former WPRR) rail line transition to UPRR's Hayward Line and then transition to I-880.

  This alignment option would be nearly entirely on an aerial structure that would create substantial visual impacts. The WPRR alignment would have considerable construction issues making it impracticable, including rearrangement of San Francisco Bay Area Rapid Transit District (BART) foundations to allow for the high-speed alignment to pass from one side of BART to the other. In contrast, a proposed alignment along the UPRR Hayward Line would be at grade and would follow the existing freight and commuter railroad.

- Former WPRR Rail Line through Niles Junction to Mulford Line (WPRR/Niles/Mulford alignment): From Oakland, this alignment would follow the former WPRR Rail Line onto the UPRR's Hayward Line, to UPRR's Niles Line, and then UPRR's Mulford Line.

  This alternative would be nearly entirely on an aerial structure that would create substantial visual impact. The WPRR alignment would have major construction issues making it impracticable, including rearrangement of BART foundations to allow for the high-speed alignment to pass from one side of BART to the other. In contrast, the proposed alignment along the UPRR Hayward Line would be at grade and would follow the existing freight and commuter railroad.

[13] Only the Oakland to Newark segment on the Mulford Line would be eliminated since the Newark to San Jose portion is part of the Hayward/Niles/Mulford option for further evaluation.

[14] Only the Oakland to Fremont segment of the I-880 option would be eliminated since the Fremont to San Jose portion is part of the Hayward/I-880 option carried forward for further evaluation.

- Hayward Line via tunnel to Mulford Line (Hayward/Tunnel/Mulford alignment): From Oakland, this alignment would follow south along UPRR's Hayward Line to a tunnel leading to UPRR's Mulford Line.

  The tunnel alternatives in Fremont have high projected costs, and the tunnel section would result in considerable right-of-way constraints, making this option impracticable. The purpose of a tunnel would be to improve travel times and eliminate tight curves. However, eliminating tight curves would result in tunnel alignments through the City of Fremont that do not follow under existing transportation rights-of-way. This alternative would not be compatible with the existing development and would have considerable seismic constraints.

- Former WPRR Rail Line via tunnel to Mulford Line (WPRR/Tunnel/Mulford alignment): From Oakland, this alignment would follow the former WPRR rail line, transitioning to UPRR's Hayward Line, then to a tunnel leading to UPRR's Mulford Line.

  The tunnel alternatives in Fremont have high projected costs, and the tunnel section would result in considerable right-of-way constraints making this option impracticable. The purpose of a tunnel would be to improve travel times and eliminate tight curves. However, eliminating tight curves would result in tunnel alignments through the City of Fremont that would not follow under existing transportation right-of-way. This alternative would not be compatible with the existing development and also has considerable seismic constraints.

Station Locations: The following station locations were considered and eliminated in the Oakland to San Jose section.

- Oakland Terminus Stations
  - Lake Merritt: The Lake Merritt Station would result in a high level of potential adverse effects in residential areas. Residential uses would be proximate to this potential station site, whereas land uses adjacent to the potential Jack London Square and the City Center station sites are more commercial in nature. The Lake Merritt Station and alignment would require construction of a tunnel or subway through the campus of Laney College adjacent to the BART alignment. The Lake Merritt alternative does not meet the program objectives since it would not be compatible with existing development, and would not provide sufficient connectivity and accessibility to serve the East Bay.
  - Jack London Square: The Jack London Square Station and alignment leading to and from it would be in bored tunnels in the bay mud underneath the Embarcadero and the active UPRR tracks. Relocating the railroad even temporarily is probably not an option. A cut-and-cover access would need to be constructed within the Amtrak parking lot and a concourse would need to be excavated over the bored tunnels. This station option would have the most considerable geologic challenges and soils constraints of the Oakland terminus alternatives. A terminus HST station at Jack London Square would be difficult to construct and would be the most costly alternative to serve Oakland. Although the Jack London Square location would serve a thriving commercial center and could provide a direct link to Amtrak, this terminus would not provide a connection with BART. This option is impracticable because of logistical constraints and would not meet program objectives because it would not connect with BART to provide accessibility and connectivity for the East Bay.
- Oakland Airport/Coliseum Stations
  - I-880 Hegenberger: This potential station site would only serve the I-880 (entire segment) alignment that has been eliminated from further investigation.

- Coliseum BART (WPRR): This potential station site would only serve the Mulford/Niles/WPRR alignment and I-880/WPRR alignment that have been eliminated from further investigation.

- South Alameda County Stations

  - Fremont–Warm Springs: This potential station would serve the I-880/Hayward Line. Major issues associated with the concept evaluated for the Warm Springs Station include the need to relocate the planned BART station to the east and construct the high-speed rail station and facilities between two active railroads, BART and UPRR. Relocating BART under operating conditions would have both technical and operational logistical constraints.

  - Mowry Avenue: This potential station site would only serve the I-880 (entire segment) alignment that has been eliminated from further investigation.

San Jose to Merced: The alignment and station options eliminated from further consideration in this segment are illustrated in Figure 2.6-18 and described below.

- Diablo Range Direct Options:

  - Merced Southern Alignment (Central Valley portion): This alignment would extend from the eastern base of the Diablo Range through the San Joaquin Valley to Merced (at a Merced Municipal Airport Station).

    The southern variation of the Diablo Range direct alignment has been eliminated from further investigation for Diablo Range Direct options because of potential environmental impacts. The southern alignment option would pass through approximately 4.4 mi (7 km) of sensitive wetlands, including the San Luis National Wildlife Refuge. It would also pass through floodplains, farmlands of statewide importance, and sensitive habitats. Diablo Range Direct options would use an alignment north of the San Luis National Wildlife Refuge that would minimize environmental impact.

  - Direct Tunnel Alignment (northern or southern connection to Merced): This alignment would have a station at the existing San Jose (Diridon) Station heading south on the Caltrain/UPRR just north of I-85, turning east into a long (31 mi [49.6 km]) tunnel to San Joaquin Valley to Merced (near Castle Air Force Base [AFB]).

    The direct tunnel alignment option would cross three active and potentially active fault areas in a tunnel including the Ortigalita fault, the southern extension of the Greenville fault trend, and the Calaveras fault zone. The direct tunnel alignment is likely to cost at least $3 billion more than the minimize tunnel option that would use a 3.5% gradient to minimize tunneling. This higher cost would be due largely to the long tunnel and the high unit cost per mile associated with tunnels that exceed 6 mi (9 km) in length. The direct tunnel concept would involve construction of a tunnel that would be among the longest in the world (31 mi [49.6 km]) through mixed soil and geology types. The results of the Authority's technical tunnel conference indicated that, while not impossible, a tunnel of this length in California would be extremely expensive to construct, operate, and maintain, and would therefore be impracticable.

- Pacheco Pass Options:

  - Caltrain/Morgan Hill/Foothill/Pacheco Pass Alignment: This alignment would extend south along the Caltrain/UPRR rail corridor, traveling south in the foothills east of US-101 through the Pacheco Pass and the San Joaquin Valley to Merced.

The Caltrain/Morgan Hill/Foothill/Pacheco Pass alignment is the least costly of all alignments in this section, primarily due to less tunneling and its shorter length compared to the other Pacheco Pass alignments. However, this alignment would have potentially substantial impacts on sensitive habitat (through the foothills) and would have high visual impacts. This new transportation corridor through the foothills would not be compatible with existing and planned development; would result in potentially severe impacts on the existing suburban, rural, and open space areas in the foothills; and would provide minimal connectivity and accessibility. It would not link to the Caltrain commuter rail service south of San Jose.

- Caltrain/Morgan Hill/East 101/Pacheco Pass Alignment: This alignment would extend south along the Caltrain/UPRR rail corridor, transitioning to south US-101 east through the Pacheco Pass and the San Joaquin Valley to Merced.

  The Caltrain/Morgan Hill/East 101/Pacheco Pass alignment option is similar to the Caltrain/Morgan Hill/Pacheco Pass option, with the exception that it would use the US-101 corridor to connect to the Caltrain corridor north of Morgan Hill as opposed to south of Morgan Hill. This option would not meet basic program objectives because it would have poor compatibility with development and insufficient connectivity and accessibility. This option would not provide a direct link to the Caltrain commuter rail service south of San Jose. This alignment would pass through the longest length of floodplain of all the Pacheco Pass options.

Station Locations: The following station locations were considered and eliminated in the San Jose to Merced section.

- Morgan Hill (Foothills): This potential station site would only serve the Pacheco Pass/Foothills/Morgan Hill/Caltrain alternative that has been eliminated from further investigation. This option would have poor connectivity and accessibility and not meet the basic program objectives.
- Morgan Hill (East of 101): This potential station would only serve the Pacheco Pass/East of 101/Caltrain alternative that has been eliminated from further investigation. This option would have poor connectivity and accessibility and not meet the basic program objectives.

Bay Area to Merced Options Carried Forward

The following alignments and stations are being analyzed in this Program EIR/EIS for this region (see Figure 2.6-19).

San Francisco to San Jose: The alignment and station options carried forward for further consideration in the Program EIS/EIR in this segment are illustrated in Figure 2.6-20 and discussed below.

- Caltrain Corridor (Shared-Use Four-Track Alignment): From San Francisco, this alignment would follow south along the Caltrain rail alignment to San Jose. This option assumes that the HST system would share tracks with Caltrain commuter trains. The entire alignment would be grade separated. Station options would include a station in the lower level of the proposed new Transbay Terminal in San Francisco, a station at 4th and King Streets, a station in Millbrae (near SFO), a station in either Redwood City or Palo Alto, and an optional station in Santa Clara.

  For HST service on the San Francisco Peninsula, sharing track with Caltrain is the only realistic alternative for a direct link to San Francisco because of the lack of sufficient available right-of-way along the Peninsula and the high cost of acquiring additional right-of-way.

Sharing track with Caltrain would require that the steel-wheel-on-rail HST technology be selected if the HST system is to serve San Francisco without a transfer. Unlike the dedicated (exclusive guideway) options, which would require tall elevated structures along the Caltrain or US-101 rights-of-way and extensive purchases of additional right-of-way, the Caltrain corridor shared-use option would take advantage of the existing rail infrastructure and would provide service mostly at grade.

Travel times for the Caltrain shared-use four-track alignment option are estimated to be about 5 min longer than dedicated alternatives. For the shared-use options, there would be a potential for delays or reduced service frequency for HSTs because of the need to share the tracks. The four-track alignment option would considerably reduce this potential for delays or reduced service frequency by eliminating the possibility of local Caltrains service or freight service slowing or blocking HST service since the two middle tracks would be used for HST and express Caltrain services.

Station Locations Carried Forward: The following station options are carried forward for the San Francisco to San Jose segment for further consideration in this Program EIR/EIS.

- Transbay Terminal: This potential station would serve the Caltrain shared-use option as a multimodal downtown terminal station.
- 4th and King: This potential station would serve the Caltrain shared-use four-track option as a multimodal downtown terminal station.
- Millbrae (San Francisco International Airport): This potential station would serve as a multimodal connection with San Francisco International Airport.
- Redwood City: This potential station would provide accessibility and serve the populations between San Jose and San Francisco.
- Palo Alto: This potential station would provide accessibility and serve the populations between San Jose and San Francisco.
- Santa Clara: This potential station would serve as a connection to San Jose International Airport

Oakland to San Jose: The alignment and station options carried forward for further consideration in the Program EIS/EIR in this segment are illustrated in Figure 2.6-21 and discussed below.

- Hayward Line to I-880 (Hayward Alignment/I-880): From Oakland, this alignment would travel south following the UPRR's Hayward Line and then transition to I-880. Station options include downtown Oakland, OAK/Coliseum, and Union City (BART Station).

  The Hayward Line to I-880 would provide the shortest alignment (42 mi [67.6 km]), the fastest travel time (25 min), and the highest ridership and revenue potential of the East Bay options. It would also potentially have the lowest capital costs. The alignment would be at grade along the Hayward Line and on an aerial structure in the median of I-880. (The I-880 HST option would mostly be on an aerial configuration from San Jose to Fremont.) This alternative is compatible with existing and planned development. However, the construction of columns and footings in the wide median of I-880 and of a tunnel under the lake in Fremont Central Park would result in potential impacts.
- Hayward Branch through Niles Junction to Mulford Line (Hayward/Niles/Mulford Alignment): From Oakland, this alignment would travel south along UPRR's Hayward Line to UPRR's Niles Line and then onto UPRR's Mulford Line. Station options include downtown Oakland, the OAK/Coliseum, Union City (BART Station), and Fremont (Auto Mall Parkway).

This option is the alignment currently used by the existing Amtrak Capitol Corridor intercity passenger rail service. This alignment would provide low capital costs, an opportunity for connectivity, and potential partnership/incremental improvements with the existing Capitol Corridor service.

This alignment would be longer (46 mi [74 km]) and slower than the other option carried forward. The longer travel times would occur on alignments using the existing Niles Junction tracks, which have some considerable right-angle turns that would require trains to slow and would result in travel times at least 6 min longer than the I-880 to the Hayward Line alternative. The Mulford Line portion of this alignment would result in impacts from traversing 4 mi (6 km) of the Don Edwards San Francisco Bay National Wildlife Refuge (within the existing tracks), a major wildlife and bird sanctuary.

Station Locations Carried Forward: The following station options are carried forward for the Oakland to San Jose segment for further consideration in this Program EIR/EIS.

- West Oakland: This potential station would serve Oakland (the primary market on the East Bay) from both the Hayward/Niles/Mulford Line and the Hayward/I-880 Line.
- 12th Street/City Center: This potential station would serve both the Hayward/Niles/Mulford Line and the Hayward/I-880 Line.
- Coliseum BART Station (Hayward/Mulford): This potential station would serve the Oakland Airport from both the Hayward/Niles/Mulford Line and the Hayward/I-880 Line.
- Union City: This potential station would serve the population centers between Oakland and San Jose from both the Hayward/Niles/Mulford Line and the Hayward/I-880 Line.
- Fremont (Auto Mall Parkway): This potential station would serve the population centers between Oakland and San Jose from the Hayward/Niles/Mulford Line.

San Jose to Merced: The alignment and station options carried forward for further consideration in the Program EIS/EIR in this segment are illustrated in Figure 2.6-22 and discussed below.

- Diablo Range Direct Alignments (Northern Tunnel, Minimize Tunnel, and Tunnel Under Park Options): These alignment options would have a station at the existing San Jose (Diridon) Station heading south on the Caltrain/UPRR, just north of I-85 turning east through the Diablo Range to the San Joaquin Valley to reach Merced using the northern alignment (near Castle AFB). Three alignment options were developed to better define this general corridor: the northern tunnel, minimize tunnel, and tunnel under park options. The potential station option is the existing San Jose (Diridon) Station.

  The Diablo Range direct alignment options (about 91 mi [146 km] long) would be shorter than the Pacheco Pass alignment options by approximately 24 mi (38 km) and would offer faster travel times from Sacramento to the Bay Area. They would be approximately 22 min faster from Sacramento to San Jose than the Caltrain/Gilroy/Pacheco Pass alignment for express (nonstop) services. For local trains traveling from San Jose to Los Angeles, the Diablo Range direct alignment would save 11 min compared to the Gilroy/Pacheco Pass alignment that has local stops in Gilroy and Los Banos (express service travel times would be about the same). There would be operational cost savings for this service, given that the amount of alignment traveled for the Diablo Range direct alignment would be approximately 64 mi (103 km) shorter than the Gilroy/Pacheco Pass alignment for service between Sacramento and San Jose. In addition, the Diablo Range direct alignment option would place the Merced area on the Los Angeles to Bay Area line, with more frequent train services compared to the Sacramento to Bay Area line.

The Diablo Range direct minimize tunnel alignment option would require about 16 total mi (26 km) of tunneling, with no continuous tunnel exceeding 5 mi (8 km). This alignment would bisect a portion of the Henry W. Coe State Park and Habitat Conservation Area and would be located several miles south of the nearest access road (SR-130). A variation of this alignment, the Diablo Range direct tunnel under park alignment option, would be in a deep twin-bore tunnel throughout the portion that bisects Henry W. Coe State Park. This option would have about 20 mi (32 km) of total tunneling (with no single tunnel exceeding 5.5 mi (8km) in length). The third Diablo Range direct option bypasses the Henry W. Coe State Park to the north and has access to SR-130 is also analyzed as part of this Program EIR/EIS. The northern tunnel variation would include about 19 mi (31 km) of total tunneling (with no single tunnel exceeding 5.5 mi [8 km] in length).

- Pacheco Pass Options:
  - Caltrain/Gilroy/Pacheco Pass Alignment: This alignment would extend south along the Caltrain/UPRR rail corridor through the Pacheco Pass and then the San Joaquin Valley to Merced. Station options include the existing San Jose (Diridon) Station, Gilroy (near the existing Caltrain Station), and Los Banos (near I-5) in the San Joaquin Valley.

    Both Pacheco Pass options would require less tunneling between San Jose and Merced than other options. Tunneling through this pass could be reduced to a total as little as about 5 mi (8 km). This Pacheco Pass alignment would provide potential HST service to the Morgan Hill or Gilroy and the Los Banos areas. In addition, this alignment would best serve the Salinas/Monterey Bay populations. This alignment would have impacts on natural resources and social and economic resources, but it would better avoid areas with erodible soils and steep slopes than other Pacheco Pass options.

  - Morgan Hill/Caltrain/Pacheco Pass Alignment: This alignment would extend south along the Caltrain/UPRR rail corridor through the Pacheco Pass and San Joaquin Valley to Merced. Station options include the existing San Jose (Diridon) Station, Morgan Hill (near the existing Caltrain Station), and Los Banos (near I-5) in the San Joaquin Valley.

    This alignment would be shorter than the Gilroy alignment by 3 to 4 mi (4 to 6 km) and would reduce impacts on water resources, farmlands, and floodplains compared to the Gilroy/Caltrain/Pacheco Pass option, but it would encounter erodible soils and steep slope constraints. Travel times and costs would be slightly improved with this option, but there would be a reduction in connectivity and accessibility to the region as a whole since Gilroy could not be served directly. Moreover, no existing transportation corridor links the Pacheco Pass to Morgan Hill via the Pacheco Pass.

Station Locations Carried Forward: The following station options are carried forward for the San Jose to Merced segment for further consideration in this Program EIR/EIS.

- San Jose (Diridon): This potential station would serve all alignment options (Caltrain/Monterey Highway rights-of-way) out of San Jose.
- Morgan Hill (Caltrain): This potential station would serve the Pacheco Pass/Gilroy/Caltrain and Pacheco Pass/Caltrain/Morgan Hill alignment options.
- Gilroy: This potential station would serve the Pacheco Pass/Gilroy/Caltrain option.
- Los Banos: This potential station would serve the Pacheco Pass/Gilroy/Caltrain and Pacheco Pass/Caltrain/Morgan Hill alignment options.

B. SACRAMENTO TO BAKERSFIELD

Some of the alignments investigated during the initial screening were existing rail corridors. These existing rail corridors included UPRR and Burlington Northern Santa Fe (BNSF) throughout the proposed HST alignment, and Central California Traction (CCT) from Sacramento to Stockton.

As a worst-case scenario for the existing rail corridor alignments, it was assumed that between Sacramento and Bakersfield the HST system would operate primarily on separate tracks adjacent to or very near the existing rail right-of-way and would share right-of-way with the existing freight railroads for relatively short distances in some urban areas.

Being adjacent to an existing rail corridor would facilitate serving Central Valley downtown station locations while limiting impacts on agricultural lands and potentially limiting the segmentation (splitting) of existing land parcels that could result from acquiring right-of-way for a proposed HST system. Impacts would be reduced to the extent that the proposed system used existing rail rights-of-way.

Although the proposed HST alignment generally follows existing rail corridors, in some instances the alignment diverges from the rail corridors. Such a divergence may be proposed for several reasons, including avoiding impacts to a community along the route, connecting to a proposed station site, straightening curves, or switching between the individual rail alignments to connect the sections of the system.

An express loop option was also considered as part of this Program EIR/EIS for some downtown station options in this region where there would be speed restrictions and/or considerable impacts on a community by running HSTs in an urban area. An express loop would allow for high-speed service on two express tracks routed on a new rail alignment around constrained urban areas. The urban station location would be served by two local tracks along the more constrained existing rail alignment.

<u>Sacramento to Bakersfield Options Eliminated</u>

This region of central California includes a large portion of the Central Valley (San Joaquin Valley) from Sacramento south to Bakersfield. To facilitate the analysis, this region was divided into seven segments.

- Sacramento to Stockton.
- Stockton to Modesto.
- Modesto to Merced.
- Merced to Fresno.
- Fresno to Tulare.
- Tulare to Bakersfield.
- Bakersfield to Los Angeles Connectors.

The alignment and station options considered in each segment of the Sacramento to Bakersfield region are discussed below and compared in detail in Appendix 2-H.

Two new potential high-speed rail alignments, one west of SR-99 (W99) and one east of SR-99 (E99), crossed all seven segments of the region. Creating a new transportation corridor for a proposed HST system, either the W99 or the E99, would require cutting through mostly agricultural lands roughly 2 to 5 mi (3 to 8 km) from SR-99. In most instances, these alignments would not serve existing downtown areas and existing population centers, and would therefore result in the placement of stations in outlying suburban locations at a distance from population centers. Such stations would provide lower ridership and revenue potential and poorer connectivity and accessibility than potential stations in cities and on existing rail alignments. These alignments would result in increased potential for impacts on agricultural lands and natural resources and would have high severance impacts through the Central Valley. In addition, the proposed W99 and the E99 alignments would have the potential to contribute to development sprawl and to increase development pressure on agricultural lands. The proposed E99 alignment would result in a longer route than other alignment options and thus longer travel times.

The scoping and screening comments received from federal, state, regional, and local agencies, as well as the public, generally supported the concept of locating a proposed HST system along an existing rail corridor to the greatest extent possible. These same entities were generally opposed to the creation of a new transportation corridor and new station sites in relatively undeveloped areas in the Central Valley. Considering the benefits of being adjacent to an existing rail corridor, along with the scoping comments, the Authority and the FRA determined to analyze potential alignments adjacent to existing rail corridors in this Program EIR/EIS. The Authority and the FRA determined to eliminate E99 and W99, and the outlying stations associated with those alignments because they would not avoid or substantially reduce potential environmental impacts and because they would not meet basic project purpose and objectives.

The following alignment and station options were also considered and eliminated for this region (see Figures 2.6-23 and 2.6-24). The reasons for elimination of each option in this region are categorically summarized in Table 2.6-7 and further described below. If an alignment option was eliminated, the station options that were unique to that alignment option were also eliminated.

Table 2.6-7
Sacramento to Bakersfield High-Speed Train Alternative Alignment and Station Options Considered and Eliminated

	Reason for Elimination							
Alignment or Station	**Construction**	**Incompatibility**	**Right-of-Way**	**Connectivity/ Accessibility**	**Revenue/ Ridership**	**Alignment Eliminated**	**Environment**	**Environmental Concerns**
Sacramento to Stockton								
Southern Pacific (SP) River Line/WPRR	P		S				S	Parklands, farmlands
Station Locations								
Curtis Park		S				P	P	Land use, cultural resources, visual, parks
Executive Airport					S	P		
Freeport West		S			S	P		Land use
Cal Expo Fairgrounds	S		P	P				
Stockton to Modesto								
W99				P			P	Farmlands, water resources, floodplains
Station Locations								
Farmington Road				P			S	Water resources, farmlands

Alignment or Station	Construction	Incompatibility	Right-of-Way	Connectivity/ Accessibility	Revenue/ Ridership	Alignment Eliminated	Environment	Environmental Concerns
	Reason for Elimination							
Stockton Metropolitan Airport				P			S	Floodplains, farmlands
Modesto to Merced								
E99				P			P	Farmlands
W99				S	P		P	Farmlands
Station Locations								
Modesto West				P	S		P	Farmlands
Modesto Empire		P		P				
Modesto East				P	S			
Merced to Fresno								
W99				P			P	Farmlands
E99/BNSF				P	S		P	Farmlands, parks
Station Locations								
University of California at Merced						P	S	Farmlands, wetlands
Plainsburg				P		P	S	Farmlands
Fresno to Tulare								
W99				P			P	Farmlands
E99				P			P	Farmlands
Station Locations								
Fresno West				P	S		P	Farmlands
Chandler Field		P		P				
Fresno Amtrak Station	P	S	P	S				
Fresno Yosemite International Airport		P	P	P				
Fresno East				P	S	P	S	Farmlands, water resources
Tulare to Bakersfield								
W99 (extension of Fresno to Tulare W99 option)						P		
E99 (extension of Fresno to Tulare E99 option)						P		
Station Locations								
Tulare West				S		P		
Tulare Airport				P	P			
Tulare East County				S	S	P	S	Water resources, parks
Bakersfield to Los Angeles Connectors								
Bakersfield Station to I-5 via Comanche Point Connector						P		
Bakersfield Station to I-5 via Comanche Point Connector via Union Ave						P		

Alignment or Station	Reason for Elimination: Construction	Incompatibility	Right-of-Way	Connectivity/ Accessibility	Revenue/ Ridership	Alignment Eliminated	Environment	Environmental Concerns
Station Locations								
Bakersfield West		P				P	P	Farmlands
Bakersfield East					P	P	P	Farmlands
Bakersfield South					S	P		
Old Amtrak Station		P						
Definitions:								
Reason: Primary (P) and secondary (S) reasons for elimination.								
Construction: Engineering and construction complexity, initial and/or recurring costs, that would render the project impracticable and logistical constraints.								
Environment: High potential for considerable impacts to natural resources, including streams, floodplains, wetlands, and habitat of threatened or endangered species that would fail to meet project objectives.								
Incompatibility: Incompatibility with current or planned local land use as defined in local plans that would fail to meet project objectives.								
Right-of-Way: Lack of available rights-of-way or extensive right-of-way needs would result in high acquisition costs and/or delays that would render the project impracticable.								
Connectivity/Accessibility: Limited connectivity with other transportation modes (aviation, highway and/or transit systems) would impair the service quality, could reduce ridership of the HST system, and would fail to meet the project purpose.								
Ridership/Revenue: The alignment or station would result in longer trip times and/or have suboptimal operating characteristics and would have low ridership and revenue and would fail to meet the project purpose.								
Alignment Eliminated: Station or connection eliminated because the connecting alignment option was eliminated.								

Sacramento to Stockton: The alignment and station options eliminated from further consideration in this segment are illustrated in Figures 2.6-25 and 2.6-26.

- Southern Pacific (SP) River Line/WPRR: This alignment extends south from the Sacramento downtown station location on the SP-River Line to the WPRR alignment to Stockton.

  The SP River Line/WPRR alignment potentially has competitive travel times, but it has logistical constraints because it would require an elevated crossing over I-5 and tunneling under Third Street for a subterranean downtown station site, all within a very short distance of a densely developed urban area. Additionally, this alignment would have impacts on parklands and traverse environmentally sensitive areas south of Sacramento, and would require the development of a new rail corridor through developing areas. This option would be impracticable because of major construction issues.

Station Locations: The following station locations were considered and eliminated in the Sacramento to Stockton section.

- Curtis Park: This potential station site would only serve the SP-River Line alignment alternative that has been eliminated from further investigation. In addition, this site does not meet project objectives because it is south of downtown in a dense residential area, making it incompatible with existing and planned development. Further, it would have visual impacts because of its proximity to residential areas, and it would result in impacts on parkland and on cultural resources.

- Executive Airport: This potential station site would only serve the SP-River Line alignment option that has been eliminated from further investigation. In addition, this site does not meet project objectives because it is in a suburban location considerably south of downtown and would result in reduced ridership and revenue potential.
- Freeport West: This potential station site would only serve the SP-River Line alignment that has been eliminated from further investigation. In addition, this site does not meet project objectives because it is in a suburban location considerably south of downtown and would result in reduced ridership and revenue potential, and it is incompatible with existing and planned development.
- Cal Expo Fairgrounds: This potential site was put forward during the public comment phase of the program. The lack of easy access to the site by existing rail (Amtrak or Sacramento light rail) would result in poor connectivity and accessibility. This site is impracticable because of severe right-of-way constraints and construction issues.

Stockton to Modesto: The alignment and station options eliminated from further consideration in this segment are illustrated in Figure 2.6-26. The W99 is the only alignment option eliminated from consideration in this segment, and that option is discussed previously in this section before the segment-by-segment discussions. The station options eliminated that are not on the E99 and W99 alignment options are discussed below.

Station Locations: The following station locations were considered and eliminated in the Stockton to Modesto section.

- Farmington Road: This potential station location would be between the BNSF railroad right-of-way and SR-4, Farmington Road, just east of SR-99. This station site would be approximately 8 mi from downtown and from the growing areas of Stockton. It would have impacts on water resources and farmlands, and does not meet the project objectives because it has insufficient connectivity and accessibility.
- Stockton Metropolitan Airport[15]: This potential station site is on the UPRR alignment from Sacramento to Stockton. This station site would be more than 8 mi from downtown and from the growing areas of Stockton. It would not meet the project objectives because it provides poor connectivity and accessibility and would result in substantial impacts on farmlands and floodplains.

Modesto to Merced: The alignment and station options eliminated from further consideration in this segment are illustrated in Figure 2.6-27. The proposed E99 and the W99 alignments are the only alignment options eliminated from further consideration in this segment, and those options are discussed previously in this section before the segment-by-segment discussions. The station options associated with them were also eliminated from further consideration as discussed previously. One additional station option is discussed below.

Additional Station Location:

- Modesto Empire: This potential station site would occupy portions of a BNSF rail yard in the Empire section of Modesto. This station site is on the BNSF alignment south of the Amtrak Briggsmore option. This proposed station site would not meet the project objectives because

[15] America West stopped commercial services in September 2003. San Joaquin County is actively seeking new commercial carriers.

it is not compatible with existing or planned development. In addition, it would have insufficient connectivity and accessibility and would be subject to freight rail interaction and potential conflicts.

Merced to Fresno: The alignment and station options eliminated from further consideration in this segment are illustrated in Figures 2.6-27 and 2.6-28. The proposed E99 and W99 alignments are the only alignment options eliminated from further consideration in this segment, and those options are discussed previously in this section before the segment-by-segment discussions. The station options associated with them were also eliminated from further consideration as discussed above. One additional station option is discussed below.

Additional Station Location:

- Merced University: This potential station site is located within an area now being redesigned for university and new community uses on the E99 alignment option, which has been eliminated from further investigation. In addition, the station would impact proposed development areas; threatened and endangered species; and a considerable amount of farmlands, wetlands, and flood-prone areas.

Fresno to Tulare: The alignment and station options eliminated from further consideration in this segment are illustrated in Figures 2.6-28 and 2.6-29. The proposed E99 and W99 alignments are the only alignment options eliminated from further consideration in this segment, and those options are discussed previously in this section before the segment-by-segment discussions. The station options associated with them were also eliminated from further consideration as discussed above. Three additional station options are discussed below.

Additional Station Locations:

- Chandler Field: This potential station site is not currently served by any rail line. Thus, it would require the construction of a new connector from the UPRR alignment, which would result in disruption to land uses along the new line and would be incompatible with planned and existing development. It would also have insufficient connectivity and accessibility and thus would not meet the project objectives.
- Fresno Amtrak Station: This potential station site is the current Amtrak site along the BNSF mainline. It is impracticable because the BNSF alignment is a single track with no excess right-of-way available for expansion. In addition, it would result in high construction impacts because it is a constrained urban site, and it would have operational issues because there are low-speed curves in the alignment near the station. It would also not meet the project objectives because it would have insufficient connectivity and accessibility and is not compatible with existing and planned development. Further, the costs would be high because of right-of-way issues and because it is a constrained urban site.
- Fresno Yosemite International Airport: This potential station site would make use of a portion of Fresno Yosemite International Airport, a large transportation site in the region. However, a suitable high-speed alignment to the site could not be found, which makes this option impracticable. An earlier E99 HST alignment to connect this site would have run on a former rail alignment through the center of the City of Clovis and on a new alignment thorough parts of eastern Fresno. These routes were considered too disruptive. A new E99 HST alignment has since moved farther east of this site to make use of a conceptual, joint freeway alignment, but that alignment has also been eliminated. Further, this site is not compatible with existing and planned development.

Tulare to Bakersfield: The alignment and station options eliminated from further consideration in this segment are illustrated in Figures 2.6-29 and 2.6-30. The proposed E99 and W99 alignments are the only alignment options eliminated from further consideration in this segment, and those options are discussed previously in this section before the segment-by-segment discussions. The station options associated with them were also eliminated from further consideration as discussed above. One additional station option is discussed below.

Additional Station Location:

- Tulare Airport: This potential station site would be located on the UPRR alignment. It would not meet project objectives because it would have low ridership and revenue potential, and would provide insufficient connectivity and accessibility.

Bakersfield to Los Angeles Connectors: Several alignment options were studied to the south and east of Bakersfield to connect to the mountain crossing alignment options considered in the Bakersfield to Los Angeles region. The connecting alignment and station options eliminated from further consideration in this segment are also illustrated in Figure 2.6-30 and discussed below.

- Bakersfield Station to I-5 via Comanche Point Connector: This alignment would diverge from the SR-184/Wheeler Ridge Road alignment option heading south-southeast to Comanche Point to the base of the Tehachapi Mountains where it would connect with the Bakersfield-to-Los Angeles corridor.
- Bakersfield Station to I-5 or Comanche Point Connector via Union Avenue: This alignment would extend south along Union Avenue from a Bakersfield station location, to a point south of the urban area where, depending on the alignment crossing the Tehachapi Mountains, it would either continue south generally following I-5 or would head southeast to Comanche Point.

Alignment options connecting to Comanche Point from the south and the station options associated with them were not recommended for further study based on the analysis and data in the Los Angeles to Bakersfield regional study. Because of construction issues and seismic constraints (see the discussion of the Bakersfield to Sylmar segment under the discussion for the Bakersfield to Los Angeles region), they were determined to be impracticable.

Additional Station Locations:

- Old Amtrak Station: This station is located along the BNSF route near freight yards just south of Truxton Avenue near K Street and Chester Avenue. This potential site would not meet project objectives because it would not be compatible with existing and planned development.

Sacramento to Bakersfield Options Carried Forward

The following alignments and stations are being analyzed for this region (see Figures 2.6-31 and 2.6-32).

Sacramento to Stockton: The alignment and station options carried forward for further consideration in the Program EIS/EIR in this segment are illustrated in Figures 2.6-33 and 2.6-34 and discussed below.

- UPRR: This potential alignment extends east from the Sacramento Rail Depot to an embankment near California State University Sacramento. North of Lodi the alignment would diverge from the UPRR to the CCT that would bypass Lodi because of extensive geometric (alignment) and right-of-way constraints and would reconnect to the UPRR to serve the proposed downtown Stockton station site.

The UPRR alignment is a direct route that serves both Sacramento station sites recommended for further review. This proposed alignment would have high ridership and revenue potential and would be consistent with existing and planned development. Additionally, utilizing an existing rail corridor would reduce potential impacts on natural resources, agricultural lands, and adjacent properties.

- CCT: This potential alignment would extend southeast from the proposed Power Inn Road station location.

  CCT, like UPRR, would provide high ridership and revenue potential and would be consistent with existing and planned development in that corridor. Additionally there is low population along the route (between Sacramento and Stockton) and the current freight rail owners are considering abandoning the line. Although CCT is a longer route than the other alignment option being considered in this segment, it bypasses Lodi and would provide a direct connection with an express loop option around Stockton and a connection to UPRR to serve the proposed downtown Stockton station site.

Station Locations:

- Sacramento Downtown: Located at the existing Amtrak station, this potential downtown station site would connect to other modes effectively, is close to the I-5 and other freeway connections, and is close to government and downtown business destinations. This site would provide high ridership and revenue potential, would be compatible with existing and planned development, and would not result in impacts on agricultural lands. The City of Sacramento and various regional transportation agencies have indicated support for including a proposed HST system at the Sacramento downtown site.
- Power Inn Road: Located on Power Inn Road south of US-50 and north of Fruitridge Road, this potential station would be located in a largely industrial area. It would have minimal impacts on social and economic resources compared to other options and lower capital costs than some options. This site would be accessible to the growing suburban region of Sacramento, and it would provide good intermodal access to light rail and US-50.

Stockton to Modesto: The alignment and station options carried forward for further consideration in the Program EIS/EIR in this segment are illustrated in Figures 2.6-34 and 2.6-35 and discussed below.

- Express Loop/BNSF: This potential alignment would allow high-speed through service while providing service to the proposed downtown Stockton ACE station. Both the stopping and through tracks would diverge from the UPRR/CCT north of Stockton and would converge with the BNSF alignment southeast of Stockton.

  The proposed downtown ACE station would be served by two tracks on the UPRR through downtown that would be used by local HST services stopping in Stockton. Two additional tracks on a new rail alignment would be routed to the east of Stockton, avoiding urban disruption for express services that would not stop in Stockton. An express loop option would reduce impacts on downtown Stockton while providing high ridership and revenue potential, good accessibility, and connectivity to other transit modes. The BNSF alignment leaving Stockton toward Modesto would provide ridership and revenue potential, good connectivity and accessibility, and would be compatible with existing and planned development while limiting impacts on natural resources. BNSF would provide the shortest alignment to Modesto.

- Express Loop/UPRR: This potential alignment would allow for high-speed through service while providing service to the proposed Downtown ACE station. The stopping track would continue on the UPRR alignment to the proposed station site, and the through tracks would diverge from the UPRR/CCT north of Stockton and would converge back with the UPRR south of Stockton.

  The UPRR alignment would provide direct service to the proposed Downtown ACE station and a direct connection with a downtown Modesto station. This alignment would provide high ridership and revenue potential, good connectivity and accessibility, and would be compatible with existing and planned development while limiting impacts on natural resources.

Station Locations:

- Downtown ACE: This potential station site is the former Southern Pacific depot and the current terminal of ACE service to San Jose. Because of the tight curves on the existing rail line through downtown Stockton that would limit maximum speeds, an express track outside of the urban area would be needed in order to provide high-speed service. This potential station site would provide high ridership and revenue potential, and good connectivity and accessibility, while limiting potential impacts on natural resources. The downtown station site is supported by the city of Stockton as the preferred potential HST system station location for Stockton.

Modesto to Merced: The alignment and station options carried forward for further consideration in the Program EIS/EIR in this segment are illustrated in Figures 2.6-35 and 2.6-36 and discussed below.

- BNSF: This potential alignment is adjacent to the BNSF extending south from the proposed Modesto Amtrak Briggsmore station location to downtown Merced.

  The BNSF alignment would provide a direct alignment to Merced that would avoid or reduce impacts on established communities, compared to the UPRR alignment in this segment. Additionally, this alignment would result in minor impacts on cultural resources and only minor impacts on social and economic and natural resources.

- UPRR: This potential alignment would be adjacent to the UPRR extending south from the proposed downtown Modesto station location to downtown Merced.

  The UPRR alignment would provide direct service to the proposed downtown Modesto station and the downtown Merced station. This alignment would provide high ridership and revenue potential and good connectivity and accessibility. It would be compatible with existing and planned development, and it would have only limited potential impacts on natural resources.

Station Locations:

- Modesto SP Downtown: This potential station site was formerly the SP rail station and is currently the Modesto Transportation Center. This site is compatible with existing and planned development. It would provide high ridership and revenue potential, and good connectivity and accessibility. Because the proposed downtown Modesto station site would be on a constrained corridor, consideration of an express loop option would be required for this station site and for the UPRR alignment between Modesto and Merced.
- Modesto Amtrak Briggsmore: This potential station site would be located at the existing Amtrak station on Held Drive north of Briggsmore Avenue on the BNSF alignment. This is a suburban site in the growth areas of the metropolitan Modesto area. The site could serve as a transfer point for Amtrak San Joaquin service. This site is compatible with existing and

planned development, and would likely avoid impacts on social and economic, and cultural resources.

Merced to Fresno: The alignment and station options carried forward for further consideration in the Program EIS/EIR in this segment are illustrated in Figures 2.6-36 and 2.6-37 and discussed below.

- UPRR: This potential alignment would extend south from Merced to a downtown Fresno station location.

  The UPRR alignment would provide direct service to the proposed downtown Merced station and the downtown Fresno station. The alignment would provide high ridership and revenue potential and good connectivity and accessibility. It would be compatible with existing and planned development.

- BNSF: This potential alignment would extend south from Merced to a downtown Fresno station location.

  To serve the proposed Castle or Merced Municipal Airport station sites while avoiding impacts on developed urban areas, the alignment would diverge from the BNSF onto a new high-speed rail alignment connecting to either of the station sites and would converge with the BNSF south of Merced. North of Fresno, if the proposed Fresno rail consolidation plan were implemented through Fresno consolidating the BNSF rail alignment onto the UPRR corridor, the BNSF alignment would serve the proposed downtown Fresno station site. If the rail consolidation did not move forward, however, the alignment from Merced would diverge from the BNSF onto the UPRR north of Fresno to serve the proposed Fresno station site. Being adjacent to an existing rail corridor would reduce potential impacts on agricultural land and adjacent properties.

Station Locations:

- Merced UPRR Downtown: This potential station site is on the UPRR alignment near the city center and would be the transit hub of Merced on the UPRR route. The downtown station site would provide high ridership and revenue potential and good connectivity and accessibility, while limiting or avoiding potential impacts on natural resources.
- Castle: This potential station site is located at the decommissioned Castle AFB close to the BNSF alignment coming from Modesto. The Castle site would require a divergence from the BNSF to connect to the station site. The divergence would connect to the UPRR alignment south of Merced. This site would provide little disruption to local access patterns. There would be easy access to and from the developing University of California Merced campus and community via a new highway alignment along Bellevue Avenue.
- Merced Municipal Airport: This potential station site is located on the grounds of the existing Merced Municipal Airport complex southwest of SR-99. This station site would require a divergence from the BNSF to connect to UPRR. This site would be located at a considerable distance from the developing University of California Merced, but it would be adjacent to downtown Merced. This site would be compatible with existing and planned development.

Fresno to Tulare: The alignment and station options carried forward for further consideration in the Program EIS/EIR in this segment are illustrated in Figures 2.6-37 and 2.6-38 and discussed below.

- UPRR: This potential alignment is the continuation of the UPRR alignment from Merced and would extend southeast from the proposed downtown Fresno station to the proposed Visalia airport station site.

  The UPRR alignment would provide good connectivity and accessibility, and the most direct service from the proposed downtown Fresno station to Visalia. Being adjacent to an existing rail corridor would limit potential impacts on agricultural lands and other adjacent properties. The alignment would be consistent with the existing and planned development in the area.

- BNSF: This potential alignment extends south from Fresno to a Hanford station site.

  Currently the BNSF alignment in Fresno runs through residential areas on a narrow single-track right-of-way, crossing many local streets, and proposed HST system use would require grade separations, would entail considerable costs, and would result in visual impacts. However, as part of the rail consolidation plan being proposed by the Fresno Council of Governments, the BNSF line would be relocated into the UPRR alignment north of Fresno and would diverge from the UPRR south of Fresno. If the rail consolidation plan were implemented, this alignment would provide good connectivity and accessibility and the most direct service from the proposed downtown Fresno station to Hanford. If the rail consolidation plan were not implemented, however, the alignment to the north of Fresno would be diverted from the BNSF to the UPRR alignment to connect with the proposed downtown Fresno station location and would converge with the BNSF south of Fresno.

Station Locations:

- Fresno Downtown: This potential station site is located within the UPRR right-of-way in downtown Fresno and is the site currently being studied in the rail consolidation study.

  The Fresno downtown station site would be closest to the city center as well as the triangle formed by the SR-99, SR-41, and SR-180 highways, which would provide good connectivity and accessibility and would result in high ridership and revenue potential. This station would be compatible with existing and planned development and is the preferred choice of the City of Fresno. The downtown station site would be close to freeways and to the urban core, provide a straight alignment in a largely industrial corridor, and have only limited potential impacts on residential properties. Conceptual analysis was done for a four-track high-speed station that could fit on this site next to existing and future freight rail operations. Since there could be high right-of-way, land use and noise impacts associated with a four-track HST alignment (220-mph or 354-kph trains through Fresno), an express loop to the west of the urban area is being considered as part of this Program EIR/EIS. An express loop would require two stopping tracks downtown and two through tracks to the west of Fresno.

Tulare to Bakersfield: The alignment and station options carried forward for further consideration in the Program EIS/EIR in this segment are illustrated in Figures 2.6-38 and 2.6-39.

- UPRR: This potential alignment would extend south from the proposed Visalia airport station location to Bakersfield.

  The UPRR alignment would provide the most direct link to Bakersfield with high ridership and revenue potential and good connectivity and accessibility in this area. It would be compatible with existing and planned development and would serve the Visalia Airport station site as well as the station locations in Bakersfield. A divergence from the UPRR line to bypass Tulare is being considered as part of this Program EIR/EIS to avoid and/or minimize potential impacts.

- BNSF: This potential alignment extends south from the proposed downtown Hanford station site to Bakersfield.

  The BNSF alignment would serve a downtown Hanford station site with a connection to the proposed Bakersfield Truxton station site. Because this potential alignment would require an express loop around Hanford (as a result of speed-restricting curves through Hanford) it would result in some impacts on agricultural lands and natural resources.

- UPRR/BNSF: This potential alignment would extend south from the proposed Visalia Airport station location to just north of Bakersfield, where the UPRR alignment proceeds to the southeast as it enters Bakersfield. From this point, the alignment option would continue south on a new rail alignment where it would converge with BNSF just west of Bakersfield.

  The UPRR/BNSF alignment would have high ridership and revenue potential and would provide good connectivity and accessibility. It would be compatible with existing and planned development and would serve the Visalia station site. This variation of the UPRR alignment would provide the best connection to the proposed Truxton station site with an SR-58 connection into the Antelope Valley. The UPRR portion of this alignment could result in impacts on communities along the route. This Program EIR/EIS is considering a divergence from the UPRR line to bypass Tulare to mitigate potential impacts.

- BNSF/UPRR: This potential alignment extends south from the proposed Hanford Station site along BNSF to just north of Bakersfield. From this point the alignment option would continue southeast on a new rail alignment where it would converge with UPRR just north of Bakersfield.

Station Locations:

- Visalia Airport: This potential station site would be located along the UPRR alignment near the junction of SR-99 and SR-198 at the Visalia Airport. It would provide good connectivity and good ridership and revenue potential, and it would result in only limited potential impacts on natural resources, with the exception of potential impacts to floodplain areas. This centralized site would serve the populations of Tulare and Kings Counties. This is the site preferred by the City of Visalia and is supported by the County of Tulare.
- Hanford: This potential station site would be located along the BNSF alignment in the vicinity of the existing Amtrak station in Hanford. The Hanford station site would likely avoid impacts on social and economic, natural, and cultural resources.

Bakersfield to Los Angeles Connectors: Several alignment options were studied to the south and east of Bakersfield to connect to the mountain crossing alignment options considered in the Bakersfield to Los Angeles region. The connecting alignment and station options carried forward for further consideration in the Program EIR/EIS are discussed below. These alignment options are included in the discussion and appendix tables for the Bakersfield to Sylmar segment of the Bakersfield to Los Angeles region.

- Bakersfield Station to I-5 Connectors: This alignment would extend east along the UPRR alignment from a Bakersfield station location and south along SR-184/Wheeler Ridge Road or Union Avenue, and would generally follow the I-5 to the base of the Tehachapi Mountains where it would connect with the Bakersfield to Los Angeles corridor.
- Bakersfield Station to SR-58 Connector: This alignment would extend from a Bakersfield station location along SR-58 east from Bakersfield where it would connect with the Bakersfield to Los Angeles corridor.

Station Locations:

- Truxton: This potential downtown station site is located just east of the new Amtrak station in downtown Bakersfield near Truxton Avenue and R Street. This proposed site would provide high ridership and revenue potential and good connectivity and accessibility. It would be compatible with existing and planned development and would likely avoid impacts on cultural resources and result in only limited impacts on natural resources. This site would be served by the BNSF or UPRR/BNSF alignment options from the north, and would serve the I-5 and SR-58 connectors to the Bakersfield to Los Angeles corridor. The UPRR alignment could also serve the Truxton site by construction of a loop line through downtown Bakersfield.
- Golden State: This potential downtown station site would be located along the existing UPRR alignment that parallels Golden State Avenue in the northern part of downtown Bakersfield. This proposed site would provide high ridership and revenue potential and would likely avoid impacts on social and economic resources. This site would be served by the UPRR or BNSF/UPRR alignment options from the north, and would serve the I-5 and SR-58 connectors to the Bakersfield to Los Angeles corridor.
- Bakersfield Airport: This potential station site would be located along the existing UPRR alignment just west of SR-99 and south of 7th Standard Road, which is planned for freeway expansion. This proposed site would be compatible with existing and planned development, would likely avoid social and economic and cultural resources, and would result in only limited potential impacts on natural resources. This site would be served by the UPRR or BNSF/UPRR alignment options from the north, and would serve the I-5 and SR-58 connectors to the Bakersfield to Los Angeles corridor.

C. BAKERSFIELD TO LOS ANGELES

This region of southern California encompasses the southern portion of the Central Valley south of Bakersfield, the mountainous areas between the Central Valley and the Los Angeles basin, and the northern portion of the Los Angeles Basin from Sylmar to downtown Los Angeles. To facilitate analysis, this corridor was divided into two segments.

- Bakersfield to Sylmar.
- Sylmar to Los Angeles.

These segments are fundamentally different and distinct in terms of land use, terrain, and construction configuration (mix of at-grade, aerial structure, and tunnel sections). The Sylmar to Los Angeles section is located in the Los Angeles basin and is characterized by existing urban development. The Bakersfield to Sylmar section traverses rugged terrain crossing the Tehachapi Mountains. The alignment and station options considered in each segment of the Bakersfield to Los Angeles region are discussed below and compared in detail in Appendix 2-H.

Bakersfield to Los Angeles Options Eliminated

The following alignments and stations were considered and eliminated for this region (see Figure 2.6-40). The reasons for elimination of each option in this region are categorically summarized in Table 2.6-8 and further described in the subsections that follow. A summary discussion of each option follows.

Table 2.6-8
Bakersfield to Los Angeles: High-Speed Train Alternative Alignment and Station Options Considered and Eliminated

Alignment or Station	Reason for Elimination: Construction	Incompatibility	Right-of-Way	Connectivity/ Accessibility	Revenue/ Ridership	Alignment Eliminated	Environment	Environmental Concerns
Bakersfield to Sylmar								
I-5 (2.5% grade)	P						S	Seismic constraints
I-5 via Comanche Point	P						S	Seismic constraints
SR-58/Soledad Canyon (2.5% grade)	P						S	Seismic constraints
SR-138/Soledad Canyon	P						S	Seismic constraints
SR-138/SR-14	P						S	Seismic constraints
Aqueduct/Soledad Canyon	P						S	Lengthy run adjacent and parallel to San Andreas fault zone, seismic constraints
Aqueduct/SR-14	P						S	Lengthy run adjacent and parallel to San Andreas fault zone, seismic constraints
Station Locations								
Santa Clarita (SR-126/I-5)	P			P			S	Santa Clara River Floodplain, visual
Santa Clarita (Magic Mountain Parkway/I-5)				P				
Santa Clarita (Via Princessa/SR-14)	P							
Santa Clarita (The Old Road/I-5)	P	S	P	P			P	Significant Ecological Area, steep terrain, visual
Santa Clarita (San Fernando Road/SR-14)	P	S					P	Significant Ecological Area, national forest land, steep terrain, visual
Lancaster Metrolink	S				P			
Palmdale Boulevard			P	P	P			
Sylmar to Los Angeles								
I-5 Freeway	P	S	P				P	Socioeconomics, land use, visual, parks
Station Locations								
LAUS (LAUS South–Stub)					P			*operational issues with stub-end station

Alignment or Station	Reason for Elimination: Construction	Incompatibility	Right-of-Way	Connectivity/ Accessibility	Revenue/ Ridership	Alignment Eliminated	Environment	Environmental Concerns
LAUS (Los Angeles River West)		P	P					
LAUS (Cornfield Site)		P		S	P			*operational issues for northern and southern connections

Definitions:

Reason: Primary (P) and secondary (S) reasons for elimination.

Construction: Engineering and construction complexity, initial and/or recurring costs that would render the project impracticable and logistical constraints.

Environment: High potential for considerable impacts to natural resources, including streams, floodplains, wetlands, and habitat of threatened or endangered species that would fail to meet project objectives.

Incompatibility: Incompatibility with current or planned local land use as defined in local plans that would fail to meet project objectives.

Right-of-Way: Lack of available rights-of-way or extensive right-of-way needs would result in high acquisition costs and/or delays that would render the project impracticable.

Connectivity/Accessibility: Limited connectivity with other transportation modes (aviation, highway and/or transit systems) would impair the service quality, could reduce ridership of the HST system, and would fail to meet the project purpose.

Ridership/Revenue: The alignment and station would result in longer trip times and/or have suboptimal operating characteristics and would have low ridership and revenue and would fail to meet the project purpose.

Alignment Eliminated: Station or connection eliminated because the connecting alignment option was eliminated.

Bakersfield to Sylmar: The alignment and station options eliminated from further consideration in this segment are illustrated in Figure 2.6-41 and discussed below.

- I-5 (2.5% grade): This alignment extends east along the UPRR alignment from a Bakersfield station and then south along SR-184/Wheeler Ridge Road. It generally follows I-5 over the Tehachapi Mountains through Santa Clarita to Sylmar.

  The I-5 (2.5% grade) alignment alternative would have extensive tunneling and high capital costs. This option would be impracticable because it would not allow the alignment to cross the San Andreas and Garlock faults at grade and would require a maximum single tunnel length of more than 33 mi (53 km). Crossing the faults at grade would allow for less expensive initial infrastructure and infrastructure replacement in the event of a serious seismic event. It also would allow for immediate emergency response and repair.

- I-5 via Comanche Point: This alignment would extend east along the UPRR alignment from a Bakersfield station; south along SR-184; then south-southeast to Comanche Point along an existing power easement, tunneling from Comanche Point and converging back with the I-5 alignment.

  The I-5 via Comanche Point alignment would traverse a region of highly sheared and fractured rock between the San Andreas and Garlock faults, crossing both faults in a long, deep tunnel. This alignment would closely follow the existing California Aqueduct tunnel alignment through the Tehachapi Mountains. Based on the experience in constructing that facility, tunneling through fractured rock would require slow drill-and-blast methods for long portions of the alignment. Because the area between the faults is highly sheared and unstable, an enlarged chamber could be required for the entire reach between the two faults. Additionally, high volumes of groundwater would likely be encountered in fractured rock, making construction more difficult and expensive. For these reasons, this would be an impracticable option.

- SR-58/Soledad Canyon (2.5% grade): This alignment would extend from Bakersfield along SR-58 east from Bakersfield, generally following SR-58 through the Tehachapi Mountains to Mojave, along MTA/Metrolink through Antelope Valley and Soledad Canyon and generally following SR-14 from Santa Clarita to Sylmar.

  The SR-58/Soledad Canyon at 2.5% grade alignment option would have extensive tunneling and high capital costs, and would not allow the alignment to cross the San Andreas and Garlock faults at grade, making it impracticable.

- SR-138/Soledad Canyon: This alignment option in the California Aqueduct corridor would extend east along the UPRR alignment from a Bakersfield station; south along SR-184; then south-southeast to Comanche Point along an existing power easement, tunneling under the Tehachapi Mountains near the California Aqueduct. It then would veer to the east along SR-138 to the MTA/Metrolink through Soledad Canyon and generally following SR-14 from Santa Clarita to Sylmar.

  Reasons for elimination of this alignment option are discussed in the following bullet with the reasons for elimination of the SR-138/SR-14 option.

- SR-138/SR-14: This alignment would diverge from the MTA/Metrolink, generally following SR-14 to Sylmar.

  The SR-138/Soledad Canyon and SR-138/SR-14 alignments would require long (greater than 12 mi or 19 km), deep tunneling through the Garlock fault zone. The tunneling associated with the SR-138 alignment would result in considerably higher construction costs and risks, making these options impracticable.

- Aqueduct/Soledad Canyon: This alignment would extend east along the UPRR alignment from a Bakersfield station; south along SR-184; then south-southeast to Comanche Point along an existing power easement, tunneling under the Tehachapi Mountains near the California Aqueduct. It would generally follow the aqueduct to SR-14 through Soledad Canyon, and then generally follow SR-14 from Santa Clarita to Sylmar.

  This option would closely parallel the San Andreas fault for a long distance, creating a long length of track and infrastructure that could be subject to high seismic shaking and potential ground movement. Additionally, this option would require long, deep tunneling through the Garlock fault zone with associated high costs that would make this option impracticable.

- Aqueduct/SR-14: This option in the aqueduct corridor would follow the same alignment as the aqueduct/Soledad Canyon option. The exception is that this alignment would generally follow SR-14 through the Antelope Valley to Sylmar.

  This option would closely parallel the San Andreas fault for a long distance, creating a long length of track and infrastructure that could be subject to high seismic shaking and potential ground movement. Additionally, this option would require long, deep tunneling through the Garlock fault zone with associated high costs that would make this option impracticable.

Station Locations:

- Santa Clarita (SR-126/I-5): This station site would be located immediately east of the SR-126/I-5 interchange in close proximity to the freeway-to-freeway interchange bridges and ramps, which would require either an aerial or a tunnel approach to the station site. A tunnel approach would require a widened tunnel with special ventilation and life safety systems, which would present considerable construction challenges. An overhead approach would require a structure that spans the existing interchange bridges and could accommodate the necessary crossovers and station tracks. Deep cuts/fills, drainage requirements, retaining walls, and highway access requirements for this site would also result in substantially higher station construction costs. Additionally, this station site would be in an area that is affected, in part, by flooding from the Santa Clara River and adjacent to an existing oil field that is designated as Mineral/Oil Conservation Area Open Space. Further, because the site is in an undeveloped area, it would result in visual impacts and insufficient connectivity and accessibility. This site would be impracticable because of logistical constraints and its inability to avoid or substantially reduce environmental impacts, compared to other potential sites.
- Santa Clarita (Magic Mountain Parkway/I-5): This station site would be located immediately north of a potential tunnel on the I-5 alignment. The proximity of the station platforms to the tunnel portal would necessitate a widened tunnel cross-section to accommodate the crossovers and switching tracks to serve the platform tracks from the mainline tracks. This tunneling widening would require special ventilation and life safety considerations and would present considerable construction challenges. The site does not meet the project objectives primarily because it has insufficient connectivity and accessibility.
- Santa Clarita (Via Princessa/SR-14): This station site would require the widening of a tunnel at its northeastern end to accommodate crossovers and switching tracks as well as a portion of the platform length. This configuration would require special ventilation and life safety considerations and would present considerable logistical constraints and high construction costs. Because no proposed or existing intermodal connection exists near this proposed station site, Via Princessa, a major arterial planned for a minimum of six lanes, would have to be extended to accommodate access to this station site. This site would be impracticable due to logistical constraints.
- Santa Clarita (The Old Road/I-5): This potential station site would not provide existing road access and would therefore have substantial right-of-way impacts. The Old Road site also has insufficient connectivity and accessibility, high potential visual and parklands impacts, and is not compatible with existing and planned development. This station site would be impracticable due to severe right-of-way constraints, high construction issues, and high costs.
- Santa Clarita (San Fernando Road/SR-14): This potential station site would not provide access to the existing roadways, and would have high construction issues and costs making it impracticable. This site also is not compatible with existing and planned development, would have high potential visual and parkland impacts and would not avoid or substantially reduce potential environmental impacts.
- Lancaster Metrolink Station: This station does not meet project objectives because it would provide poor connectivity and ridership potential due to its distance from the Palmdale Airport, local and regional bus service, and a planned Palmdale Metrolink stop.
- Palmdale Boulevard: This station does not meet project objectives because it would provide poor connectivity and ridership potential due to its distance from the Palmdale Airport, local and regional bus service, and a planned Palmdale Metrolink stop. In addition, it would have considerable right-of-way constraints.

Sylmar to Los Angeles: The alignment and station options eliminated from further consideration in this segment are illustrated in Figure 2.6-42 and 2.6-43 and discussed below.

- I-5 Freeway: This alignment would extend southeast generally following I-5 from Sylmar to the area of LAUS. It would be required to diverge from I-5 in several places because of tight highway curvature that would severely compromise operating speeds for the proposed HST system.

  Although the I-5 alignment would have the fastest travel times, it would have substantial land use impacts. Because of the tight curvature of the freeway, the alignment would have to diverge from I-5 in several places, which would result in potentially extensive land use impacts and substantial right-of-way acquisition in heavily urbanized areas. Therefore, this alignment would have severe impacts on social and economic resources (established housing, businesses), and would be incompatible with the existing development. The I-5 alignment option would have high costs because it would involve substantial right-of-way and property acquisition, tunneling, and considerable use of aerial structures to pass over existing overpasses and connector ramps and would therefore be impracticable. These aerial structures would also result in visual impacts. Further, it would impact parklands because it would pass on an aerial structure through several parks.

Station Locations:

- Sylmar (Roxford Street): This potential station site would be located at the convergence of five major freeways (I-5, SR-14, I-210, I-405, and SR-118) and in close proximity to SR-170. This station site would serve both the MTA/Metrolink and the combined I-5/Metrolink alignments. No feasible alignment options were identified. This alignment option was eliminated because of logistical constraints.

  Engineering analysis subsequent to the screening evaluation revealed an infeasible vertical profile through the station area. No feasible alignment revisions were identified.

- LAUS (LAUS South-Stub Configuration): This station would have severe operational impacts because it would not allow for through services other than for LAX to Inland Empire or San Diego connections. Further, its proposed location is considered sensitive for cultural and historical resources. This station does not meet project objectives because operational constraints result in insufficient ridership and revenue potential.

- LAUS (Los Angeles River West): This station site located north and east of LAUS would displace an existing MTA bus yard being considered as a maintenance yard site for the Eastside LRT extension, which would result in high right-of-way constraints. Further, it would not meet project objectives because it would be incompatible with the existing and planned development.

- LAUS (Cornfield Site): This station site located north of LAUS does not meet project objectives because it would have low connectivity and slow approach speeds, and would not connect to the combined I-5/UPRR alignment. In addition, it is located on a site that has been proposed for park development and is included in the Los Angeles River Greenbelt planning effort.

Bakersfield to Los Angeles Options Carried Forward
The following alignments and stations are being analyzed for this region (Figure 2.6-44).

Bakersfield to Sylmar: The alignment and station options carried forward for further consideration in the Program EIS/EIR in this segment are illustrated in Figure 2.6-45 and discussed below.

- I-5 (3.5% maximum grade): This alignment would extend east along UPRR from a Bakersfield station, south along SR-184/Wheeler Ridge Road or Union Avenue, and would generally follow I-5 over the Tehachapi Mountains through Santa Clarita to Sylmar.

  The I-5 alignment would provide the most direct route from Bakersfield to Sylmar, and would provide high ridership potential. Based on the information derived from focused studies on tunneling and alignment refinement, a portion of the proposed alignment was diverted slightly to the east to facilitate the crossing of both major fault zones (San Andreas and Garlock) at grade, with a total of 18 mi (29 km) of tunneling and a maximum tunnel length of 6 mi (10 km).

- SR-58/Soledad Canyon (3.5% maximum grade): This alignment would extend from Bakersfield along SR-58 east from Bakersfield, generally following SR-58 through the Tehachapi Mountains to Mojave, along MTA/Metrolink through Antelope Valley and Soledad Canyon (Soledad Canyon refers to a relatively wide corridor area that includes both the SR-14 and UPRR alignments between the Antelope Valley and Santa Clarita), and then generally following SR-14 from Santa Clarita to Sylmar.[16]

  The SR-58/Soledad Canyon at 3.5% maximum grade alignment would reduce the need for tunneling (20.7 mi [33.4 km] of total tunneling), reduce capital costs, and allow the alignment to cross both the San Andreas and Garlock faults at grade to meet project objectives. This alignment would generally follow existing highway and/or railroad rights-of-way, resulting in limited impacts to existing development and adjacent land use, and providing good construction access.

Station Locations:

- Palmdale Transportation Center: This potential station would be located at the existing Palmdale Transportation Center and would serve the SR-58/Soledad Canyon alignment, providing good connectivity and accessibility while limiting impacts on social and economic and cultural resources. The Palmdale Transportation Center is being planned as a key hub for transportation systems (bus, auto, commuter rail, and high-speed rail) in the Antelope Valley area.

Sylmar to Los Angeles: The alignment and station options carried forward for further consideration in the Program EIS/EIR in this segment are illustrated in Figures 2.6-46 and 2.6-47 and discussed below.

- MTA/Metrolink: This alignment would extend southeast generally following the MTA/Metrolink alignment between Sylmar and the LAUS area. Station options along this alignment would include Sylmar (Roxford Street and Sylmar Metrolink Station), Burbank (Burbank Airport and Burbank Metrolink Station), and the LAUS area (three configurations: existing LAUS, LAUS South Through, and Los Angeles River east).

  The MTA/Metrolink alignment option would have relatively low costs because construction would be at grade between downtown Los Angeles and Burbank, with trenching along the remainder of the alignment up to Sylmar. This would accommodate many grade crossings north of Burbank. However, this option would result in longer travel times. This alignment would provide opportunities for incremental implementation of high-speed service because it

[16] The SR-14 between the Antelope Valley and Santa Clarita alignment option was recommended to be eliminated from further investigation by the Authority's and FRA's April 2002 Screening Report. However, during further development of the options for study in this document it was determined that the Soledad Canyon corridor should be defined to include the SR-14 alignment option.

would use the existing railroad right-of-way. Additionally, this alignment option would be compatible with existing and planned development.

- Combined I-5/Metrolink: This alignment would extend southeast following the Metrolink alignment from Sylmar to Burbank Metrolink Station, and then would generally follow I-5 to a tunnel under Elysian Park to the LAUS area. Station options along this alignment would include Sylmar (Roxford Street and Sylmar Metrolink Station), Burbank (Burbank Airport and Burbank Metrolink Station), and the LAUS area (two configurations: existing LAUS and LAUS South Through).

  The combined I-5/Metrolink alignment would provide high ridership and revenue potential, as well as better travel times, than the MTA/Metrolink option. By following the straight MTA/Metrolink corridor from Sylmar to Burbank and using the I-5 corridor south of Burbank, this alignment would avoid the curvature of the railroad right-of-way, resulting in fewer operating constraints. However, this alternative would be more costly, require tunneling, and be less compatible with existing development than the MTA/Metrolink alignment.

Station Locations:

- Sylmar (Sylmar Metrolink): This potential station site would be located at the convergence of five major freeways (I-5, SR-14, I-210, I-405, and SR-118) and in close proximity to SR-170. Additionally, this site would provide connectivity and accessibility to other modes of transportation. This station site would serve both the MTA/Metrolink and the combined I-5/UPRR alignments.
- Burbank Airport: This potential station site would serve both the MTA/Metrolink and the combined I-5/UPRR alignments.
- Burbank Metrolink/Media City: This potential station site would serve both the MTA/Metrolink and the combined I-5/UPRR alignments.
- LAUS (Existing LAUS): This potential station site would provide connectivity to other transportation modes, avoid impacts to the Los Angeles River, and connect with the UPRR/ El Monte/Colton alignment to Inland Empire.
- LAUS (LAUS South Through): This potential station site would provide connections for the UPRR/El Monte alignment to Inland Empire and would connect to the LOSSAN and LAX corridor regions.
- LAUS (Los Angeles River East): This potential station site would serve the MTA/Metrolink alignment, be compatible with existing/planned development, have lower capital costs than some other potential station sites, and connect with the LOSSAN corridor region.

D. LOS ANGELES TO SAN DIEGO VIA INLAND EMPIRE

This region of southern California includes the eastern portion of the Los Angeles basin from downtown Los Angeles east to the Riverside and San Bernardino areas and south to San Diego generally along the I-215 and I-15 corridors. To facilitate this analysis, this region has been divided into three sections.

- Los Angeles to March Air Reserve Base (ARB).
- March ARB to Mira Mesa.
- Mira Mesa to San Diego.

These sections are fundamentally different and distinct in terms of land use, terrain, and construction configuration (mix of at-grade, aerial structure, and tunnel sections). The Los Angeles to March ARB and the Mira Mesa to San Diego sections are similar in terms of existing urban constraints; however, the March ARB to Mira Mesa section is much less developed and traverses mountainous terrain in the southern portions. The alignment and station options considered in each section of the Los Angeles to San Diego via Inland Empire region are discussed below and compared in detail in Appendix 2-H.

Los Angeles to San Diego via Inland Empire Options Eliminated

The following alignments and stations were considered and eliminated for this section (see Figure 2.6-48). The reasons for elimination of each of the options in this region are categorically summarized in Table 2.6-9 and further described in the subsections that follow. A summary discussion about each option follows.

Table 2.6-9
Los Angeles to San Diego via Inland Empire High-Speed Train Alternative Alignment and Station Options Considered and Eliminated

Alignment or Station	Reason for Elimination							
	Construction	Incompatibility	Right-of-Way	Connectivity/ Accessibility	Revenue/ Ridership	Alignment Eliminated	Environment	Environmental Concerns
Los Angeles to March Air Reserve Base								
UPRR Riverside Line					P		S	Cultural resources, wildlife refuges
I-10	P						S	
SR-60	P						S	Water resources, wetlands
BNSF Fullerton Line/SR-91	P	S			S		P	Water resources, wetlands, visual, parks, cultural
Station Locations								
Ontario International Airport (South side)						P		
Downtown Riverside						P		
Fullerton Transportation Station						P		
March Air Reserve Base to Mira Mesa								
I-215/I-15 Alignment—Long Tunnel	P							
Station Locations								
Temecula/Murrieta Border (I-15 near Winchester Interchange)				P				
Mira Mesa to San Diego								
SR-163 to Santa Fe Station	P	P					P	Balboa Park, cultural resources
SR-52		P	P				S	4(f), Marian Bear Memorial Natural Park
SR-163/I-8	P	S						

Alignment or Station	Construction	Incompatibility	Right-of-Way	Connectivity/ Accessibility	Revenue/ Ridership	Alignment Eliminated	Environment	Environmental Concerns
Station Locations								
Kearny Mesa						P		
South of University City option						P		
Definitions:								
Reason: Primary (P) and secondary (S) reasons for elimination.								
Construction: Engineering and construction complexity, initial and/or recurring costs that would render the project impracticable and logistical constraints.								
Environment: High potential for considerable impacts to natural resources, including streams, floodplains, wetlands, and habitat of threatened or endangered species that would fail to meet project objectives.								
Incompatibility: Incompatibility with current or planned local land use as defined in local plans that would fail to meet project objectives.								
Right-of-Way: Lack of available rights-of-way or extensive right-of-way needs would result in high acquisition costs and/or delays that would render the project impracticable.								
Connectivity/Accessibility: Limited connectivity with other transportation modes (aviation, highway and/or transit systems) would impair the service quality, could reduce ridership of the HST system, and would fail to meet the project purpose.								
Ridership/Revenue: The alignment and station would result in longer trip times and/or have suboptimal operating characteristics, and would have low ridership and revenue and would fail to meet the project purpose.								
Alignment Eliminated: Station or connection eliminated because the connecting alignment option was eliminated.								

Los Angeles to March ARB: The alignment and station options eliminated from further consideration in this segment are illustrated in Figure 2.6-49 and discussed below.

- UPRR Riverside Line: This alignment would extend from LAUS along the UPRR Riverside line, turn south in Riverside (near the I-215/SR-60 interchange) on the BNSF San Jacinto Line, then follow I-215 south to March ARB.

  The UPRR Riverside Line would provide the same connection to LAUS as the UPRR Riverside-UPRR Colton Line option. However, it would have logistical constraints due to a difficult curved track alignment connection through the developed urban areas City of Riverside and south to I-215 that would create community impacts (wildlife refuges, parkland impacts, and noise). In addition, it would have impacts on wildlife refuges and provide less direct access to the Ontario Airport station option with the station on the south.

- I-10: This alignment would extend from LAUS east along I-10 to I-215 and south to March ARB.

  This alignment would provide high ridership and would have low impacts on existing rail freight operations, good intermodal connections, and suitable access to the Ontario Airport station option with the station on the north. It would also allow for a connection to San Bernardino County with a potential station at Colton. However, the alignment would include a difficult connection to LAUS, which would result in reduced speed. Further, because of the limited available right-of-way along the freeway, this alignment would require the exclusive use of aerial structures for the proposed HST system, with many sections of multilevel structures being required to pass over existing overpasses and connector ramps. This would result in logistical constraints that would make this option impracticable. This freeway alignment would also require relocating and maintaining freeway access and capacity during construction. It would be difficult to find available space along the freeway alignments (for the facilities and construction of the facilities) because available right-of-way is generally planned for use for needed expansion projects such as additional lanes, high-occupancy-vehicle (HOV) lanes, and additional interchange improvements. In addition, for freeway corridors in this segment, existing commercial and industrial land uses typically abut sensitive residential properties and other commercial uses that would not be compatible with a proposed HST system. Because of the need to acquire additional right-of-way and the density of existing development, use of the I-10 freeway corridor would result in potentially considerable impacts to established local and regional parks, schools, courthouses, hospitals, universities, and cemeteries.

- SR-60: This alignment would extend from LAUS along SR-60 to I-215 and then proceed south to March ARB.

  This alignment would provide high ridership potential and a good connection to LAUS from the south end. Like the I-10 alignment, the SR-60 freeway alignment would have the constraint of limited right-of-way on the freeway, which would require the exclusive use of aerial structures for a proposed HST system, with many sections of multilevel structures required to pass over existing overpasses and connector ramps, resulting in logistical constraints and high costs that would make this option impracticable. This freeway alignment would also require relocating and maintaining freeway access and capacity during construction. It would be difficult to find available space along the freeway alignments since available right-of-way is planned for use for needed expansion projects such as additional lanes, HOV lanes, and additional interchange improvements. Further, this alignment would result in impacts on water resources in the Wittier Narrows Nature Center and high impacts on wetlands.

- BNSF Fullerton Line/SR-91: This alignment would extend from LAUS along the BNSF Fullerton Line to Fullerton, then either follow east along SR-91 to I-215 and proceed south to March ARB, or continue to follow the BNSF rail corridor to March AFB.

  There are two variations for this alignment. The alignment on SR-91 would have limited available right-of-way for the proposed HST system. The BNSF rail option would also have limited right-of-way available, since that the BNSF right-of-way currently serves Metrolink, LOSSAN, and freight service. The BNSF Fullerton Line/SR-91 options would result in considerable potential environmental impacts. Both variations of this alignment option would traverse the Santa Ana Canyon, which is heavily constrained with existing rail and highway facilities and is an environmentally sensitive area. These options result in high potential impacts on water resources, wetlands, parklands, visual, and cultural resources. Because these options would result in longer travel times, lower ridership potential, and higher environmental impacts than other options, they would not meet basic project objectives.

Station Locations:

- Cal Poly Pomona: This potential station site would serve the northeast side of campus and would serve the I-10 freeway alignment option that has been eliminated from further investigation.
- Ontario Airport, Southside Metrolink: This potential station site would only serve the UPRR Riverside Line alignment that has been eliminated from further investigation.

- Downtown Riverside at Metrolink: This potential station site would only serve the UPRR Riverside Line alignment that has been eliminated from further investigation.
- Norwalk at Metrolink: This potential station site would only serve the BNSF Fullerton Line/SR-91 alignment option that has been eliminated from further investigation.
- Fullerton Transportation Center: This potential station site would only serve the BNSF Fullerton Line/SR-91 alignment option that has been eliminated from further investigation.

March ARB to Mira Mesa: The alignment and station options eliminated from further consideration in this segment are illustrated in Figure 2.6-50 and discussed below.

- I-215/I-15 Alignment–Long Tunnel (Only the portion of this alignment in tunnels would be eliminated): This alignment would extend from Riverside to Mira Mesa in San Diego County, running along the BNSF San Jacinto Line, along I-215 past March ARB through Murrieta and Temecula, and south along I-15 to Escondido. A long tunnel was proposed along the freeway to straighten the alignment to increase potential train speed and avoid sensitive natural areas.

  The concept of using very long tunnels to reduce travel times was eliminated. Constructing long tunnels was considered impracticable because of the expensive and considerable construction issues. This alignment was designed to pick up speed outside the dense urban area of Los Angeles to Riverside and would result in slightly decreased travel time but considerably increased capital cost (more than $1 billion as compared to the option that would reduce the use of tunnels). In addition, the long tunnel alignment option would go under various private properties (not public rights-of-way) in developed areas in the communities of Temecula and Murrietta. Because of the construction difficulties, high costs, and right-of-way impacts, this option was considered impracticable.

Station Locations:

- Temecula/Murrieta Border (I-15 near Winchester Interchange): This station option does not meet the project objectives because it would have poor connectivity and accessibility.

Mira Mesa to San Diego: The alignment and station options eliminated from further consideration in this segment are illustrated in Figure 2.6-51 and discussed below.

- I-15 to SR-163 to Downtown San Diego (Santa Fe Station): This alignment would extend south along I-15 from Mira Mesa then along the east side of I-15, then south along SR-163, tunneling under highly developed downtown San Diego.

  This option would connect directly to the Santa Fe Station in downtown San Diego. It would allow a fast travel time with fewer alignment curves than other options, and would permit an average speed of 141 mph (227 kph). In addition, it would provide a good connection to the potential station at Kearney Mesa, a planned intermodal hub for San Diego County that would serve the San Diego Trolley, bus, and freeway connections. This option would also provide potential to continue south to Mexico for a future extension of the proposed HST system.

  This option would be impracticable, however, because it would result in considerable construction issues and potential impacts due to tunneling under Balboa Park and downtown San Diego, and would be very costly. This alternative would require a twin-bore tunnel 1.5 mi (2.4 km) long under the sensitive recreational and cultural resources of Balboa Park and an additional 1.5 mi of tunneling in the heavily developed urban landscape of downtown San Diego. It would also cross about 2.5 mi (4 km) of Marine Corps Air Station (MCAS) Miramar on the east, with the potential for land use conflicts with the base. The San Diego

Association of Governments (SANDAG), Metropolitan Transit Development Board (MTDB), and North County Transit District (NCTD) requested that this alternative be eliminated from further investigation. This option would not avoid or substantially reduce potential environmental impacts.

- I-15 to Coast via SR-52: This alignment would extend south along I-15 from Mira Mesa, then along the east side of I-15, then west along SR-52 to connect to the LOSSAN corridor south of UTC. The alignment would then continue in the LOSSAN corridor or other HST alignment option to the Santa Fe Depot in downtown San Diego.

  The I-15 to coast via SR-52 option would provide the longest alignment between Mira Mesa and San Diego. This option would connect to the LOSSAN corridor and to a potential HST connection to UTC on the south end of the area. Considerable curves in the alignment would reduce the potential average speed to 106 mph (171 kph), and a constrained right-of-way in a densely developed area would make this option impracticable. In addition, the alignment would cross a high school, residential areas, and Marion Bear Park along SR-52. Further, the alignment would have right-of-way issues in a constrained, densely developed area. This option would not meet basic project objectives and would not avoid or substantially reduce potential environmental impacts.

- I-15 to SR-163 to I-8 to Coast: This alignment would extend south along the east side of I-15 from Mira Mesa, south along SR-163, then west along I-8 to connect to the LOSSAN corridor. The alignment would then continue on the LOSSAN corridor or other HST alignment option to the Santa Fe Depot in downtown San Diego.

  This alignment would be impracticable because of considerable construction issues through a densely developed area, with potential for considerable land use impacts. This option would not meet project objectives because it would not be compatible with existing and planned development and it would not avoid or substantially reduce potential environmental impacts.

Station Locations:

- Kearny Mesa: This potential station site would only serve the SR-163/I-8 alignment that has been eliminated from further investigation.
- South of University Towne Centre: This potential station site would only serve the SR-52 alignment that has been eliminated from further investigation.

Los Angeles to San Diego (via Inland Empire) Options Carried Forward
The following alignments and stations are being analyzed for this corridor (see Figure 2.6-52).

Los Angeles to March ARB: The alignment and station options carried forward for further consideration in the Program EIS/EIR in this segment are illustrated in Figure 2.6-53 and discussed below.

- UPRR Colton Line: This alignment would extend east along the UPRR Colton line from the north side of LAUS, turn south in Colton (near the I-215/I-10 interchange) on the BNSF San Jacinto line, then follow I-215 south to March ARB. Station options along this alignment would include LAUS, El Monte (west of I-605), Pomona (Metrolink Station), Ontario Airport (north side), Colton Line (near San Bernardino), University of California Riverside, and March ARB.

  The UPRR Colton Line alignment would provide high ridership potential and good connectivity and accessibility, with limited capital and operating costs. The UPRR Colton Line would have less impact on existing rail freight operations than other rail alternatives. This alignment would have limited impacts on land use and would have good potential for intermodal connections. It also would allow for a connection to both Riverside and San Bernardino with a potential station at Colton. This alignment would connect to LAUS using a stub-end or difficult connection. Although it would require a considerable amount of trenching and some aerial construction, the UPRR Colton Line would provide a suitable alignment for extensive at-grade construction.

- UPRR Riverside/UPRR Colton Line: This alignment would extend south from LAUS, then east along the UPRR Riverside line, east along the UPRR Colton line, south in Colton (near the I-215/I-10 interchange) on the BNSF San Jacinto line, then follow I-215 south to March ARB. Station options along this alignment would include LAUS, City of Industry (Metrolink Station), South El Monte (west of I-605), Pomona (Metrolink Station), Ontario Airport (north side), Colton Line (near San Bernardino), University of California Riverside, and March ARB.

  The UPRR Riverside/UPRR Colton Line alignment would combine the best attributes of both the UPRR Colton Line and the UPRR Riverside Line. It would potentially provide a good connection to LAUS and would provide high ridership potential and good connectivity and accessibility, with limited capital and operating costs. This alignment would have only limited impacts on land use and would allow for a connection to both Riverside and San Bernardino with a potential station at Colton. Although it would require a considerable amount of trenching and some aerial construction, the UPRR Colton portion of this alignment would provide a suitable alignment for extensive at-grade construction.

- UPRR Colton Line to San Bernardino: This alignment would use either the UPRR Colton Line or the UPRR Riverside/UPRR Colton Line from LAUS, east to Ontario Airport. The alignment would turn north in the City of Ontario past the airport, east toward the Santa Fe Depot in San Bernardino, south from the Depot to the BNSF San Jacinto Line, then follow I-215 south to March ARB primarily along the existing BNSF/SCRRA alignment.

  This alignment would provide a direct connection to the Santa Fe Depot in the City of San Bernardino, providing service to San Bernardino County. However, redirecting the alignment up from the UPRR Colton rail line and around the Santa Fe Depot Metrolink station in the City of San Bernardino would result in tight curves, slower train speeds, and increased travel time. Refining the proposed alignment and improving the curves could result in reduced travel time and could reduce potential impacts on businesses and residences. This option would have higher capital and operational costs and longer travel times than the UPRR Colton and UPRR Riverside/UPRR Colton options.

Station Locations:

- LAUS: This potential station would serve the Los Angeles key downtown multimodal center from both the UPRR Colton and the UPRR Riverside/UPRR Colton Lines. Optional sites for this station are evaluated in the Los Angeles to Bakersfield region.
- El Monte (west of I-605): This potential station site would serve the population centers between Los Angeles and Riverside from the UPRR Colton Line.
- South El Monte (west of I-605): This potential station site would serve the population centers between Los Angeles and Riverside from the UPRR Riverside/UPRR Colton Line.
- City of Industry (Metrolink Station): This potential station site would serve the population centers between Los Angeles and Riverside from the UPRR Riverside/UPRR Colton Line.
- Pomona (Metrolink Station): This potential station site would serve both the UPRR Colton and UPRR Riverside/UPRR Colton Lines.

- Ontario Airport–Northside: This potential station site would serve Ontario Airport from both the UPRR Colton and UPRR Riverside/UPRR Colton Lines.
- UPRR Colton Line (near San Bernardino): This potential station site would serve the City of San Bernardino from both the UPRR Colton and UPRR Riverside/UPRR Colton Lines.
- University of California Riverside: This potential station site would serve the Riverside area from both the UPRR Colton and UPRR Riverside/UPRR Colton Lines.
- March ARB: This potential station site would serve western Riverside County from both the UPRR Colton and UPRR Riverside/UPRR Colton Lines.
- San Bernardino Santa Fe Depot: This potential station site would serve the City of San Bernardino from the UPRR Colton Line to San Bernardino alignment.

March ARB to Mira Mesa: The alignment and station options carried forward for further consideration in the Program EIS/EIR in this segment are illustrated in Figure 2.6-54 and discussed below.

- I-215/I-15 Alignment: This alignment would extend along the BNSF San Jacinto Line from Riverside to Mira Mesa in San Diego County, along I-215 past March ARB through Murrieta and Temecula, and south along I-15, staying within the freeway right-of-way on aerial structure just south of SR-79 (adjacent to portions of the Santa Margarita Ecological Preserve). The alignment option generally follows along the east side of the I-15 corridor to Escondido (avoiding southern portions of the Santa Margarita ecological preserve). Station options along this alignment include Murrieta at I-15/I-215 interchange, Escondido at SR-78/I-15 interchange, Escondido Transit Center, and Mira Mesa.

  The I-215/I-15 alignment would provide the same ridership potential for a substantially reduced cost (more than $1 billion less) compared to the long tunnel option, which was eliminated from further consideration. During the subsequent preliminary engineering phase of this program, this option would be refined to find the appropriate length and location of tunnels to meet both the objectives of minimizing capital and operational costs and reducing potential environmental impacts.

  Between March ARB and Mira Mesa there are no existing rail corridors, and the I-215 to I-15 alignment would provide the only viable transportation corridor as a potential HST alignment. Much of the corridor is undeveloped terrain and a considerable portion of the alignment could be constructed at grade.

Station Locations:

- Murrieta at I-15/I-215 Interchange: This potential station site would serve the Temecula/Murrieta area from the minimize tunnel alignment option.
- Escondido at SR-78/I-15 Interchange: This potential station site would serve Escondido from the minimize tunnel alignment option.
- Escondido Transit Center: This potential station site would serve Escondido from the minimize tunnel alignment option.
- Mira Mesa: This potential station site would serve Escondido from the minimize tunnel alignment option.

Mira Mesa to San Diego: The alignment and station options carried forward for further consideration in the Program EIS/EIR in this segment are illustrated in Figure 2.6-55 and discussed below.

- I-15 to Coast via Miramar Road: This alignment would extend south along I-15 from Mira Mesa, then west along Miramar Road to connect to the LOSSAN corridor near UTC. The alignment would then continue on the LOSSAN corridor[17] to the Santa Fe Depot in Downtown San Diego. Station options would include University City, the San Diego Airport, and downtown San Diego at the Santa Fe Depot.

  Although curves would reduce the average speed to 93 mph (150 kph) and this alignment option would result in impacts on the northern border of MCAS Miramar, this alignment would provide the most direct connection to the University City HST station option and to the LOSSAN corridor. Miramar Road would provide a feasible route option to link the I-15 corridor to the LOSSAN corridor and to both the potential downtown San Diego high-speed station sites (Santa Fe Depot and SAN).

- I-15 to Coast via Carroll Canyon: This alignment would extend south along I-15 from Mira Mesa, then west through Carroll Canyon to connect to LOSSAN corridor. The alignment would then continue on the LOSSAN corridor[17] to downtown San Diego.

  This alignment would avoid the northern end of the MCAS Miramar and connect, via Miramar Road, to UTC shopping center and to the LOSSAN corridor. Difficult terrain and alignment curves would reduce the average speed to 91 mph (146 kph).

- I-15 to Qualcomm Stadium: This alignment would extend south along I-15 from Mira Mesa to Qualcomm Stadium in East Mission Valley. The Qualcomm Stadium area would be the potential station site.

  This option, as initially conceived, would not provide direct access to the San Diego airport or the downtown San Diego Santa Fe Depot but would have few alignment curves and a fast average speed of 153 mph (246 kph). It also would have the shortest length (about 10 mi [16 km]), the shortest travel times (4.2 min), and the lowest cost. This line would stop at the Qualcomm Stadium. It would be necessary to transfer to the San Diego Trolley to reach downtown San Diego. Including the time of transfer and local commute, this alternative would have the longest overall travel time to the San Diego Airport or downtown San Diego Santa Fe Depot, if the time needed for the transfer and local commute is included. Additional evaluation at the request of SANDAG, MTDB, and NCTD indicated that a tunnel option to extend this alternative to serve the San Diego airport and downtown San Diego would require very deep tunneling (to avoid existing deep foundations in poor geologic conditions) and would be impracticable due to difficult and costly construction conditions.

Station Locations:

- University City: This potential station site would serve the La Jolla and northern San Diego areas from the Miramar Road alignment (see LOSSAN region).
- Qualcomm Stadium: This potential station site would serve San Diego via the I-15 alignment.
- San Diego Airport: This potential station site would serve San Diego and San Diego International-Lindbergh Field from the Miramar Road alignment and Carroll Canyon alignment.
- Downtown San Diego at the Santa Fe Depot: This potential station site would serve downtown San Diego from the Miramar Road alignment and Carroll Canyon alignment.

[17] The conceptual design assumed the HST system would operate on separate tracks.

E. LOS ANGELES TO SAN DIEGO VIA ORANGE COUNTY

This region includes the western portion of the Los Angeles basin between downtown Los Angeles and LAX and the coastal areas of southern California between Los Angeles and San Diego, generally following the existing LOSSAN rail corridor. To facilitate this analysis, this region has been divided into four sections.

- LAUS to LAX.
- LAUS to Orange County.
- Orange County to Oceanside.
- Oceanside to San Diego.

While these sections are generally similar in geography, they differ in terms of land use intensity and amount of sensitive ecological areas traversed. The alignment and station options considered in each section of the Los Angeles to San Diego via Orange County region are discussed below and compared in detail in Appendix 2-H.

<u>Los Angeles to San Diego via Orange County Options Eliminated</u>

The following alignments and stations were considered and eliminated for this region (see Figure 2.6-56). The reasons for elimination of each of the options in this region are categorically summarized in Table 2.6-10 and further described in the subsections that follow. A summary discussion about each option follows.

Table 2.6-10
Los Angeles to San Diego via Orange County High-Speed Train
Alternative Alignment and Station Options Considered and Eliminated

Alignment or Station	Reason for Elimination: Construction	Incompatibility	Right-of-Way	Connectivity/ Accessibility	Revenue/ Ridership	Alignment Eliminated	Environment	Environmental Concerns
LAUS to LAX								
I-405 and I-10	P		P				S	Environmental justice, community impacts, parks
I-105 and I-110	P		P				S	Environmental justice, community impacts
Upgrade MTA Green Line to Support HSTs	P							
LAUS to Orange County								
I-5 Freeway	P		P					
Pacific Electric Right-of-Way	P			S				
Station Locations								
Paramount (San Pedro Branch at I-105)						P		
Norwalk (I-5 at Imperial Highway)						P		

Alignment or Station	Reason for Elimination: Construction	Incompatibility	Right-of-Way	Connectivity/ Accessibility	Revenue/ Ridership	Alignment Eliminated	Environment	Environmental Concerns
Garden Grove (PE ROW at SR-22)		P		S		P	S	Community and neighborhood impacts
Anaheim I-5		P		S			S	Community and neighborhood impacts
Orange County to Oceanside								
I-5 Freeway	P		P					
San Joaquin Corridor (SR-73) with I-5	P			S				
I-5 and Foothill Corridor (SR-241)	P						S	Wetlands, threatened and endangered species, visual
LOSSAN Corridor (south of Irvine)	~~P~~						P	Visual, community impacts, and coastal resources.
Station Locations								
Irvine (I-5 at Jeffery Road)						P		
Oceanside (I-5 at Oceanside Boulevard)						P		
Oceanside Transportation Center						P		
Newport Beach						P		
Oceanside to San Diego								
LOSSAN Corridor							P	Visual, community impacts, and coastal resources.
I-5 Freeway			P	S				
Station Locations								
Solana Beach (I-5 at Lomas Santa Fe Drive)						P		
Solana Beach (LOSSAN)						P		
UTC (La Jolla and Genesee Ave.)						P		

Definitions:

Reason: Primary (P) and secondary (S) reasons for elimination.

Construction: Engineering and construction complexity, initial and/or recurring costs that would render the project impracticable and logistical constraints.

Environment: High potential for significant impacts on natural resources, including streams, floodplains, wetlands, and habitat of threatened or endangered species that would fail to meet project objectives.

Incompatibility: Incompatibility with current or planned local land use as defined in local plans that would fail to meet project objectives.

Right-of-Way: Lack of available rights-of-way or extensive right-of-way needs would result in high acquisition costs and/or delays that would render the project impracticable.

Alignment or Station	Reason for Elimination: Construction	Incompatibility	Right-of-Way	Connectivity/ Accessibility	Revenue/ Ridership	Alignment Eliminated	Environment	Environmental Concerns
Connectivity/Accessibility: Limited connectivity with other transportation modes (aviation, highway and/or transit systems) would impair the service quality, could reduce ridership of the HST system, and would fail to meet the project purpose.								
Ridership/Revenue: The alignment or station would result in longer trip times and/or have suboptimal operating characteristics and would have low ridership and revenue and would fail to meet the project purpose.								
Alignment Eliminated: Station or connection eliminated because the connecting alignment option was eliminated.								

LAUS to LAX: The alignment and station options eliminated from further consideration in this segment are illustrated in Figure 2.6-57 and discussed below.

- I-405 and I-10: This alignment option would use existing freeway corridors from LAUS to LAX. The alignment would allow for the possibility of adding a station to serve west Los Angeles communities in the future.

  This freeway alignment would have the considerable constraint of limited right-of-way on the freeways, which would require the exclusive use of aerial structures for the proposed HST system. Third or fourth level aerial construction would be required along much of the I-10 and I-405 freeways because there are elevated freeway sections and freeway interchanges along these rights-of-way. This freeway alignment would also require relocating and maintaining freeway access and capacity during construction. Available space is limited along the freeway alignments since available right-of-way is planned for use for needed expansion projects such as additional lanes, HOV lanes, and additional interchange improvements. This option would be impracticable because of logistical constraints and construction issues.

  The I-405 and I-10 alignment would cross residential areas with considerable minority and low-income populations. The alignment would result in potential impacts on those communities, and the alignment does not include a proposed station between LAUS and LAX. Further, this alignment would result in potential impacts on social and economic and cultural resources. This option would not avoid or substantially reduce potential impacts on existing communities or on parklands and wildlife refuges.

- I-105 and I-110: This option would provide a southern freeway alignment option to connect LAUS to LAX. This option would be a dedicated high-speed system (i.e., it would not share tracks with other services).

  This freeway alignment would have the considerable constraint of limited right-of-way on the freeways, which would require the exclusive use of aerial structures for the proposed HST system. Third- or fourth-level aerial construction would be required along the I-105 and I-110 freeways because of the elevated freeway sections (particularly HOV viaducts along I-105) and freeway interchanges along these rights-of-way. In addition, this freeway alignment would require relocating and maintaining freeway access and capacity during construction. Available space along the freeway alignments is limited since available right-of-way is planned for use for needed expansion projects such as additional lanes, HOV lanes, and additional interchange improvements. This option is impracticable because of logistical constraints and construction issues.

The I-105 and I-110 alignment option would cross residential areas with substantial minority and low-income populations. The alignment would result in potential impacts on those communities, and the alignment does not include a proposed station between LAUS and LAX. Further, this alignment would result in potential impacts on social and economic resources. This alignment option would not avoid or substantially reduce potential impacts to existing communities.

- Upgrade MTA Green Line to Support HST: This option would require upgrading the existing MTA Green Line to allow for higher-speed trains to share right-of-way with light rail. This alignment option was eliminated for the reasons listed below and is not included as part of the tables in Appendix 2-H.

  This impracticable option would be subject to considerable regulatory and operational barriers and would not provide a faster time than transferring to the Green Line because the proposed HST service would be constrained to run between scheduled Green Line trains. Capital costs for this alternative were not developed because it would require completely reconstructing the existing light rail alignment and stations, and potentially parts of I-105. The alignment would be impracticable because of high costs and technology constraints.

LAUS to Orange County: The alignment and station options eliminated from further consideration in this segment are illustrated in Figure 2.6-58 and discussed below.

- I-5 Freeway: This alignment would follow I-5 south of the US-101/I-5/I-10/SR-60 interchange (East Los Angeles interchange) and would involve a dedicated bypass of the freight and commuter rail corridor, and a reasonably direct alignment to central Orange County.

  Of the three dedicated alignment options,[18] the I-5 freeway option would be the slowest because of the number and size of curves on the I-5 alignment. It would be impracticable because extremely constrained right-of-way in the corridor would require the construction of high aerial structures, which would result in high construction impacts. Third- or fourth-level aerial construction would be required along I-5 because of elevated freeway sections and freeway interchanges along this right-of-way. This freeway alignment would also require relocating and maintaining freeway access and capacity during construction. Available space along this freeway alignment would be limited since available right-of-way is generally planned for use for needed expansion projects such as additional lanes, HOV lanes, and additional interchange improvements. It would provide a central Orange County station in Anaheim, which would have good freeway access and intermodal transit connections, but it would have conflict with existing and planned land uses.

- Pacific Electric Right-of-Way: This alignment would be along a lightly used rail line between Paramount and Stanton, then along an abandoned corridor to Santa Ana. Its long tangent sections could support HST operation.

  The Pacific Electric (PE) right-of-way would provide slightly faster travel times than the other option primarily because it is straighter. However, this alignment option would not meet project objectives because it would not provide sufficient accessibility and connectivity because it would be convenient to only a single freeway and it would not directly serve Anaheim and/or Irvine, the two major transit hubs in Orange County. Further, much of the

[18] Dedicated option in the LOSSAN region would not share tracks with existing Amtrak, Metrolink, or freight services.

alignment, including the Garden Grove station site, would be located in a residential neighborhood, which is currently being studied as a potential local transit corridor by both the Orange County Transportation Authority and the Gateway Cities of Southeast Los Angeles County. Therefore, it would potentially conflict with future planned development. This option would also be impracticable because of high construction impacts and high costs, with long sections abutting residential areas and potential mitigation requirements, such as trenched construction.

Station Locations:

- Paramount (San Pedro Branch at I-105): This potential station site would only serve the PE right-of-way option that has been eliminated from further investigation.
- Norwalk (I-5 at Imperial Highway): This potential station site would only serve the I-5 freeway option that has been eliminated from further investigation.
- Garden Grove (PE right-of-way at SR-22): This potential station site would only serve the PE right-of-way option that has been eliminated from further investigation. In addition, it would not meet project objectives because it would not provide sufficient connectivity and it would not be compatible with existing land use.
- Anaheim (I-5): This potential station site would serve the UPRR Santa Ana Branch Line option. This potential station would not meet project objectives because it would not provide sufficient connectivity and accessibility and would not connect with Metrolink or Amtrak services. It also would have considerable community and neighborhood impacts and would not be compatible with existing land use. The City of Anaheim has determined that the Anaheim LOSSAN station will be its multi-modal transportation hub.

Orange County to Oceanside: The alignment and station options eliminated from further consideration in this segment are illustrated in Figure 2.6-59 and discussed below.

- I-5 Freeway: This alignment would continue from Anaheim along I-5 in Orange County through Camp Pendleton to Oceanside, providing a dedicated high-speed alignment and bypassing constrained sections of the LOSSAN corridor. The station options for this I-5 alignment are Irvine (I-5 at Jeffrey Road) and Oceanside (I-5 at Oceanside Boulevard).

  The I-5 alignment option would provide the fastest express service and would be the costliest of the dedicated options because the number and size of horizontal and vertical curves on I-5 would require extensive aerial and tunnel construction to maintain speeds. Third- or fourth-level aerial construction would be required along much of I-5 because of elevated freeway sections and freeway interchanges along this right-of-way. This freeway alignment would also require relocating and maintaining freeway access and capacity during construction. Available space along this freeway alignment would be limited, since virtually all available right-of-way has been used for recent expansion projects such as additional lanes, HOV lanes, viaduct structures, and additional interchange improvements. This option would avoid sensitive areas in San Juan Capistrano and San Clemente but would result in potential land use impacts alongside the I-5 corridor, which is abutted by commercial and industrial uses in both areas. This option is considered impracticable because of high construction issues and costs, and high right-of-way constraints.

- San Joaquin Corridor (SR-73) with I-5: This option would provide a dedicated alignment, continuing from the PE right-of-way in Garden Grove. This is a southern highway option to the I-5 freeway option discussed above (which would follow I-5 through Santa Ana, Tustin, and Irvine) that would pass through some less developed parts of Orange County than the I-5 option.

The SR-73 alignment option would be more expensive than the I-5 freeway option. Because of its rolling terrain, it would require extensive tunneling. The SR-73 option would not be as accessible as the LOSSAN and I-5 freeway options because it would be convenient to only a single freeway. Moreover, this alignment would not serve either Anaheim or Irvine, and it would only connect to the PE right-of-way alignment (between LAUS and central Orange County) that has been eliminated from further evaluation (see above). This option would not meet basic project connectivity and accessibility objectives and was considered impracticable because of high right-of-way constraints and high construction impacts and costs.

- I-5 and Foothill Corridor (SR-241): This alignment option would use the right-of-way of the existing and proposed alignments of the SR-241 toll road in eastern Orange County. This alignment option would bypass the coastal communities of southern Orange County and join the I-5 alignment from San Onofre to Oceanside.

  The foothill corridor (SR-241) option would be aligned adjacent to an extension of the foothill corridor, an environmentally controversial toll road project currently being considered. Although several alternatives are being investigated for the potential extension of the toll road, only one of these alternatives would avoid the sensitive beach areas in San Clemente. The one option that would avoid the sensitive beach areas would require the creation of a new transportation corridor in an environmentally sensitive and undeveloped canyon in San Clemente, with high potential impacts to wetlands, threatened and endangered species, and visual resources. The foothill corridor option would also be the longest and slowest of the dedicated alignment options, and would have significant gradients. It was estimated to cost at least $1 billion more than the most expensive LOSSAN alternative.

  The foothill corridor (SR-241) alignment investigation assumed that the proposed infrastructure would be exclusively used by a proposed HST system. Considering the existing use issues and rail impacts in the LOSSAN corridor from existing rail operations, along with the potential impacts of a new HST system, the potential cumulative impacts of the two corridors would be far greater than a single alternative along the LOSSAN corridor. If a new HST system and infrastructure were built along the foothill corridor, shared use would likely be requested by the coastal communities of San Clemente and Dana Point. Shared use would result in diminished performance for the HST system, and the considerable expense of relocating existing Amtrak, freight, and commuter rail stations into the foothill corridor. Moreover, additional services along the foothill corridor would greatly increase the cost of building the infrastructure because of additional commuter stations, additional track requirements, and restrictive freight gradients. If a typical maximum freight gradient of 1.2% were applied, about 20 mi (32 km) of tunnel would be required for this alignment. Based on the above factors, this option was considered impracticable because of high costs, and high potential environmental impacts.

Station Locations:

- Irvine (I-5 at Jeffrey Road): This station site would only serve the I-5 freeway and foothill corridor alignment options that have been eliminated from further investigation.
- Oceanside (I-5 at Oceanside Boulevard): This station would only serve the I-5 freeway, foothill corridor, and SR-73 alignment options that have been eliminated from further investigation.
- Newport Beach: This station site would only serve the SR-73 with I-5 option that has been eliminated from further investigation.

- Oceanside Transportation Center: This station would only serve the LOSSAN corridor that has been eliminated from further investigation.

Oceanside to San Diego: The alignment and station options eliminated from further consideration in this segment are illustrated in Figure 2.6-60 and discussed below.

- I-5 Freeway: This alignment would continue from Oceanside along I-5 to San Diego, providing a dedicated high-speed alignment and bypassing sensitive coastal and other constrained sections of the LOSSAN corridor. This would provide the only option for a dedicated high-speed alignment along the coast in San Diego.

  The I-5 freeway dedicated option would provide a faster express travel time than the LOSSAN options, but it would not serve the downtown Santa Fe Depot and would terminate at the San Diego Airport. This I-5 alignment would be a very costly option because the number and size of horizontal and vertical curves on I-5 would require extensive aerial structures to maintain speeds. Third- or fourth-level aerial construction would be required along much of I-5 because of elevated freeway sections and freeway interchanges along this right-of-way. This freeway alignment would also require relocating and maintaining freeway access and capacity during construction. Available space along this freeway alignment is limited because available right-of-way is generally planned for needed expansion projects such as additional lanes, HOV lanes, and additional interchange improvements.

  This option would avoid sensitive coastal areas. However, in many places, particularly at lagoon crossings, it would share many of the environmental issues and sensitivities of the coastal areas of the LOSSAN corridor. In addition, because of the constrained right-of-way along the I-5 corridor, there would be potential property impacts on adjacent land uses, which are largely commercial and industrial but include considerable residential areas. The need for aerial construction would result in considerable potential for visual intrusion, including interference with ocean and lagoon views.

  Suitable land for station sites on the I-5 alignment would be scarce, and the development of such new stations would be incompatible with the emerging smart growth principles of San Diego County, which stress the support and development of existing transportation hubs. Therefore, this alternative would have insufficient connectivity and accessibility.

  The I-5 alignment investigation assumed that the infrastructure would be exclusively used by a proposed HST system. Therefore, with the existing rail impacts in the LOSSAN corridor and a new proposed HST system, there would be two parallel rail lines. The cumulative impacts of the two corridors would be far greater than a single alignment along the LOSSAN corridor. Combining the existing rail services and the proposed HST system in a completely new corridor with new infrastructure, which would not be fully dedicated to high-speed service, would increase costs and diminish the performance of the proposed HST system and result in extensive costs for the relocation of all existing Amtrak, freight, and commuter rail stations into the I-5 corridor. Moreover, an HST system along I-5 would cause considerable disruption to abutting land uses (and increase environmental impacts), and would result in greatly increased costs of building the infrastructure because of additional commuter stations, additional track requirements, and restrictive freight gradients.

  This option would not meet basic project objectives because of poor connectivity and accessibility to regional transit and would not avoid or substantially reduce environmental impacts. It was also considered impracticable because of high right-of-way constraints.

- LOSSAN Corridor: This option would use the existing LOSSAN rail line from Oceanside to San Diego.

From Irvine to San Diego, HST systems are not being further investigated. The travel time differential between non-electrified and electrified HST technology would not be considerable along this heavily constrained right-of-way. For the 78-mi (126-km) stretch of express service between Irvine and San Diego, electrified HSTs would only reduce potential non-electrified HST travel times by less than 3 min.

The potential visual impacts of overhead catenary structures associated with a proposed electrified HST system were of concern to the coastal communities and coastal resources, including state parks. The prior bullet train proposal and feasibility studies of the Intercity HST Commission and the Authority, as well as the scoping and screening portions of this Program EIR/EIS process, indicated substantial opposition to the overhead catenary needed for the electrified HST technology. In the San Diego region, SANDAG, transportation agencies, and cities indicated a preference for the LOSSAN corridor to be an incrementally improved non-electrified service (that would require a transfer to the statewide HST network), and for the I-15 corridor to be evaluated as an option to provide direct HST service on new infrastructure to San Diego via Inland Empire.

Station Locations:

- Solana Beach (I-5 at Lomas Santa Fe Drive): This potential station would serve only the I-5 alignment that has been eliminated from further evaluation.
- UTC (La Jolla and Genesee Ave.): This potential station would serve only the LOSSAN corridor that has been eliminated from further evaluation.
- Solana Beach (Amtrak): This potential station would serve only the LOSSAN corridor that has been eliminated from further evaluation.

Los Angeles to San Diego via Orange County Options Carried Forward
The following alignments and stations are being analyzed for this corridor (see Figure 2.6-61).

LAUS to LAX: The alignment and station options carried forward for further consideration in the Program EIS/EIR in this segment are illustrated in Figure 2.6-62 and discussed below.

- MTA Harbor Subdivision: The Harbor Subdivision alternative follows an existing rail alignment for most of the section from LAUS to LAX.

  This alignment would provide the shortest and least costly option for a potential direct connection to LAX. It would also provide the fastest travel time between LAUS and LAX (estimated at 14 min). However, this rail alignment would have the significant constraint of limited right-of-way, which would require the extensive use of aerial and trench construction through residential neighborhoods.

Station Locations:

- LAX Terminal Station: This potential HST station site would serve the MTA Harbor subdivision alignment recommended for further investigation.
- LAUS: This potential station site would serve the MTA Harbor subdivision alignment recommended for further investigation. This station option is evaluated above in the discussion of the Bakersfield to Los Angeles region.

LAUS to Orange County: The alignment and station options carried forward for further consideration in the Program EIS/EIR in this segment are illustrated in Figure 2.6-63 and discussed below.

- LOSSAN Corridor: This option would use the existing LOSSAN rail line from southeast Los Angeles to Anaheim.

  The HST level of improvement for the LOSSAN corridor would include four tracks between LAUS and Fullerton to increase capacity and reliability of the rail corridor for HSTs and other rail traffic. The improvements would also include full grade separation, bypass tracks at all stations, and the possibility of electrification. Under the lowest level of improvement, all existing Amtrak stations would be served. Station options for additional express for the highest level of improvement would include LAUS, Norwalk (Metrolink Station), and Anaheim (Amtrak/Metrolink Station at Edison Field).

  Since it would involve incremental upgrades to an existing system rather than building a new system, the LOSSAN corridor would provide by far the least costly of the options in this section (about $800 million less than the dedicated options). LOSSAN corridor alternatives would also maximize connectivity, accessibility, and compatibility with existing and planned development. Infrastructure improvements to this corridor would result in benefits for both existing intercity and commuter services that share the same tracks.

- UPRR Santa Ana Branch Line: This option would use an existing UPRR branch line from southeast Los Angeles to Anaheim, where it would connect back to the I-5 alignment. Station options for the UPRR Santa Ana Branch Line include LAUS, Norwalk (UPRR Branch at Imperial Highway), and Anaheim (I-5).

  The UPRR Santa Ana Branch Line would be the least costly of the three dedicated route options because it would traverse largely industrial and commercial areas where at-grade operations would be feasible. It would provide a Central Orange County station in Anaheim.

  This option would provide travel times similar to or slightly better than the LOSSAN corridor. Travel times for the UPRR Santa Ana Branch Line option would be more certain because the proposed HST system would not share tracks with any other traffic. This option also would provide the possibility of no-transfer operations at LAUS.

Station Locations:

- LAUS: This potential HST station site would serve both the LOSSAN corridor and the UPRR Santa Ana Branch Line. This station option is evaluated above in the discussion of the Bakersfield to Los Angeles region.
- Norwalk (Metrolink Station): This LOSSAN station site could be expanded to serve HST services.
- Norwalk (UPRR Branch at Imperial Highway): This potential station site would serve the UPRR Santa Ana Branch Line HST option.
- Anaheim (Edison Field Amtrak/Metrolink): This LOSSAN station site could be expanded to serve HST services. This site is also assumed to be the Anaheim station location for the UPRR Santa Ana Branch Line.

Orange County to Oceanside: The alignment and station options carried forward for further consideration in the Program EIS/EIR in this segment are illustrated in Figure 2.6-64 and discussed below. No HST alignments are carried forward beyond Irvine.

- LOSSAN Corridor: This option would use the existing LOSSAN rail line from Anaheim to Irvine.

  Irvine would provide the southernmost potential HST station location in Orange County, and electrification/shared-use operations on the LOSSAN corridor below Irvine were not retained for further investigation to San Diego. Therefore, electrification and shared use of the LOSSAN corridor (with HSTs) are only carried forward for further evaluation in this Program EIR/EIS between LAUS and Irvine.

  From Irvine to San Diego, HST systems are not being further investigated. The travel time differential between non-electrified and electrified HST technology would not be considerable along this heavily constrained right-of-way. For the 78-mi (126-km) stretch of express service between Irvine and San Diego, electrified HSTs would only reduce potential non-electrified HST travel times by less than 3 min.

  The potential visual impacts of overhead catenary structures associated with a proposed electrified HST system were of concern to the coastal communities and coastal resources, including state parks. The prior bullet train proposal and feasibility studies of the Intercity HST Commission and the Authority, as well as the scoping and screening portions of this Program EIR/EIS process, indicated substantial opposition to the overhead catenary needed for the electrified HST technology. In the San Diego region, SANDAG, transportation agencies, and cities indicated a preference for the LOSSAN corridor to be an incrementally improved non-electrified service (that would require a transfer to the statewide HST network), and for the I-15 corridor to be evaluated as an option to provide direct HST service on new infrastructure to San Diego via Inland Empire.

Station Locations:

- Irvine Transportation Center (ITC): This LOSSAN station could be expanded to serve HST services.

Oceanside to San Diego: No HST alignments carried forward.

2.6.10 Maintenance and Storage Facilities

Maintenance and storage facilities that would be necessary to support the HST fleet have been considered in this Program EIR/EIS. A rail system simulation model was used to determine an overall operating and maintenance concept that is responsive to the forecast representative demand and that could deliver the levels of HST service desired. Only general track locations and infrastructure configurations were developed for these facilities to guide the consideration of potential sites in this Program EIR/EIS.

Because of the constraints of existing urban development around some of the terminus station locations, it is assumed that only minimal storage and very basic service, inspection, and light maintenance functions would be integrated into the station infrastructure. The majority of the fleet storage and service, inspection, maintenance, and repair requirements are assumed to be supported at two types of independent facilities that were defined and generally sited.

- Fleet storage/service and inspection/light maintenance.
- Main repair and heavy maintenance.

Fleet Storage/Service and Inspection/Light Maintenance Facility

The desirable configuration for this facility would include tracks for "lay-up" (parking) for trainsets, a Service and Inspection (S&I) facility for inspection and light maintenance, and a train washer located on the yard approach track for exterior cleaning prior to daily train storage. In addition, adjacent to the S&I facility, on a separate track, would be a wheel truing facility capable of accommodating two cars at a time. There would also be provision for an employee administrative and comfort area.

Main Repair and Heavy Maintenance Facility
The conceptual configuration for this heavy maintenance complex includes a Wheel Truing Area, a Service and Inspection (S&I) Area, a Running Repair facility, Support Shops, Material Inventory and Distribution, Component Change-Out Area, Overhaul Shop, Heavy Repair facility and Exterior Maintenance Shop. The following descriptions are examples of the types of areas, shops and functions that have been considered for the conceptual configuration of the Main Repair and Maintenance Facility:

Wheel Truing Area
The wheel truing facility is configured to accommodate two cars. It is utilized to return wheel diameter parity and profile due to the stresses of track wear, drift, spalling, and wheel flat spots. The wheel truing machine is mounted under the floor for ease of operation. Rail cars are pulled over the machine to expedite turn around time. Candidate vehicles for wheel truing are typically identified during a programmed maintenance inspection.

Service and Inspection Area
The service and inspection area is configured as a two track "run-through" facility. Tracks are equipped with observation pits and door level platforms for ease of inspection and light repair, providing access to under car, interior floor, and roof levels. Located between this area and the main maintenance area is a "runaround" track that would allow direct access/egress to both sides of the shop.

The Running Repair Area
The running repair area is configured with raised rail mounted on post structures and observation pits with depressed side floors. The posted, raised rail provides access to under car components requiring repair or replacement. Side floor and roof height platforms are also assumed in this configuration. The observation pit is equipped with a lift device to facilitate the removal and replacement of larger, heavier component units. Platforms provided at the car body side height provide access to glass, door, and interior and exterior repair requirements. A platform at the roof level provides access to the pantograph, resistor grids and a/c components for servicing activities as required.

Support Shops
Based on the needs of specific fleet design parameters examples of shop areas and functions include the following:

> Truck Shop: equipped with a storage track and turntables for the efficient transition of trucks requiring service and trucks ready for installation. Direct access is provided to the Component Cleaning Area, (located on an exterior wall) to prepare the trucks for overhaul/heavy repair. This area includes truck hoists to facilitate efficient repair, disassembly and reassembly. Additional turntables and connecting tracks would be provided in this area to provide for the required maneuverability of truck assemblies.

> Component Cleaning Area: This enclosed work area, located on an exterior wall, would be used to pre-clean large components such as rail vehicle trucks, air compressors and air conditioning units (condensers and evaporators) prior to disassembly and repair or shipment.

> Brake Shop: This area would be used to clean, disassemble, repair, reassemble and test brake units and all brake actuators.

> Air Room: This facility would be used to clean, inspect, troubleshoot, repair, rebuild, paint, and test all types of brake valves and brake system components. The work area would be divided into

four separate sections; the valve cleaning room, the repair area, the valve painting area and the valve test area. The repair and test operations are performed in enclosed, temperature-controlled rooms. Repair operations are performed in individual workstations.

Clean Room/Electronics Shop: This enclosed, temperature controlled room would be equipped to clean, troubleshoot, repair and test trainset electronic components such as panels, relays, inverters, battery chargers, circuit cards and selected control units. Repair activities are generally performed at individual workstations using specialized electronic test equipment.

HVAC Unit Repair Shop: This area would be used to repair the components, associated with air conditioning units.

Pantograph Repair Area: This area would be located on a suspended platform at the roof level of a rail car for the removal and installation of electric propulsion energy collection components.

Battery Room: This area supports the disassembly, cleaning, testing and reassembly of multi-cell battery units.

Wheel Shop: This area supports the fabrication and repair of wheel and axle sets. Machine technology resident in this shop includes a mounting press, demount press, wheel bore, and axle lathes.

Material Inventory and Distribution Area

This area serves as the distribution point in the Main Maintenance and Repair Facility for the material required to maintain, repair, clean, service, and provide for the state of good repair of the high-speed rail fleet. The area includes a loading dock for highway vehicles, space for the storage of transitional components (wheel sets, air compressors, etc.), and equipment (cranes, forklifts, pallet shelving etc.) associated with the efficient storage and distribution of rail car components and equipment.

Component Change-Out Area

This area is configured as a four track "run-through" facility. The hoist section of this area has the capacity to lift eight coupled rail cars on two separate tracks. Located between these tracks, are two tracks configured for the removal and installation of rail car trucks. Car body posts hold the rail vehicle in place while the trucks are removed and positioned on one of the four available truck turntables for efficient transition into the Truck Shop.

Overhaul Area

This area is utilized in the life cycle maintenance program. Rail cars undergo rebuild and major component replacement on either a time or mileage based cycle. Systems and subsystems are removed, rebuilt and replaced.

Heavy Repairs

This area accommodates repairs to a rail car that requires it to be out of service for an extended length of time.

Exterior Maintenance Shop

This area provides for the cosmetic and minor body damage repair, touch-up and periodic re-painting of vehicle exteriors.

One fleet storage/service and inspection/light maintenance facility would be needed for each major branch of the HST system (i.e., Bay Area, Sacramento, and southern California). These facilities would need to be sited as near as possible to the terminal stations. Main repair and heavy maintenance facilities are generally located near the main trunk line of the system (Los Angeles to Merced), where the majority of trains would pass on a daily basis. Only one main repair and heavy maintenance facility would be necessary; however, three potential sites are considered in this analysis. The specific facilities carried forward for consideration in this Program EIR/EIS are listed below by region and illustrated in Figure 2.6-66 and 2.6-67.

A. BAY AREA TO MERCED

- West Oakland: One site for a fleet storage/service and inspection/light maintenance facility could be located two blocks northwest of where Peralta Street intersects Mandela Parkway and southeast of where the alignment is parallel to I-880.
- Los Banos: One site for a fleet storage/service and inspection/light maintenance facility to support the Pacheco Pass options could be located immediately west of where SR-165 intersects Henry Miller Avenue, also parallel with Henry Miller Avenue.
- Merced: One site for a fleet storage/service and inspection/light maintenance facility to support the Diablo Range direct alignment options could be located near Castle AFB.

B. SACRAMENTO TO BAKERSFIELD

- Sacramento (Power Inn Road): One site for a fleet storage/service and inspection/light maintenance facility could be located south of Alpine Avenue, north of Elder Creek Road, east of Power Inn Road, west of Florin Perkins, and parallel to the UPRR main track alignment.
- Bakersfield: One main repair and heavy maintenance facility could be located west of Lerdo Canal approximately halfway between 7th Standard Road and E-Lerdo Highway O.P., parallel with SR-99.

C. BAKERSFIELD TO LOS ANGELES

- Los Angeles: Two possible sites are being evaluated for a main repair and heavy maintenance facility. One site would be located immediately south of Spring Street, east of the Los Angeles River and north of Condout Street. The second site would be located immediately west of I-5, north of Mission Road, and northeast of Macy Street.

D. LOS ANGELES TO SAN DIEGO VIA INLAND EMPIRE

- San Diego: Two possible sites for a fleet storage/service and inspection/ light maintenance facility are being evaluated. The site associated with the Qualcomm Stadium option would be located immediately north of the Soledad Freeway and parallel to the Escondido Freeway. The site associated with the San Diego downtown option would be immediately east, perpendicular, and adjacent to I-805 and northwest of MCAS Miramar.

2.7 ALTERNATIVES SUMMARY

2.7.1 No Project Alternative

The No Project Alternative is the baseline for comparing the potential environmental impacts and benefits of all alternatives being analyzed in the Program EIR/EIS. The No Project Alternative consists of the state's transportation system that serves the same intercity travel market as the other alternatives. It includes the highway, air, conventional rail, and bus facilities and operations that existed in 1999–2000 as they will be after improvements that have been approved and funded in the fiscally constrained[19] and conforming RTPs, STIPs, and airport development programs (ADPs) are in place. When this financially

[19] "Fiscally constrained" or "financially constrained" plans are limited by the foreseen available funding for a project in a region.

constrained level of infrastructure improvement is analyzed with the significant growth in population and transportation demand that is projected to occur by 2020, the data show that most highways and airports serving the intercity travel market would be at capacity and experiencing a level of congestion that would severely affect the reliability of travel and the travel time between major metropolitan cities in California.

2.7.2 Modal Alternative

The Modal Alternative represents a hypothetical, reasonable build alternative to the proposed HST system consisting of expansion of highways and airports serving the same geographic areas. For consistency, the Modal Alternative was developed to provide an equivalent capacity to serve a representative demand for intercity travel, an estimate based on the independent ridership and revenue forecasts prepared for the Authority (California High Speed Rail Authority 2000).

The Modal Alternative consists of potential improvements to both highway and airport components of the statewide transportation system. The improvements considered for each mode are capacity oriented (e.g., additional traffic lanes for highways with associated interchange reconfiguration and ramp improvements; additional gates and runways for airports with associated taxiways, parking, and passenger terminal facilities). For purposes of this analysis, the projected travel demand has been allocated to the highways and airport facilities described under the No Project Alternative, to identify improvements to those facilities necessary for serving the projected intercity travel demand in lieu of HST service.

Figures 2.7-1 and 2.7-2 summarize the hypothetical improvements included in the Modal Alternative on the existing highway and airport system. The Modal Alternative consists of more than 2,900 new lane-mi (4,667 km) of highway, 6 new runways, and 68 new airport gates statewide.

Table 2.7-1 presents the number of additional lanes included in the Modal Alternative and their assumed configurations. This Program EIR/EIS assesses the potential impacts associated with the implementation of this alternative in comparison with the other system alternatives.

Table 2.7-1
Improvement Definition for Highways

Highway Corridor	Segment (From–To)	No. of Additional Lanes[a] (Total–Both Directions)	No. of Existing Lanes (Total–Both Directions)	Type of Improvement
Bay Area to Merced				
US-101	San Francisco to SFO	2	8	Widening
US-101	SFO to Redwood City	2	8	Widening
US-101	Redwood City to I-880	2	8	Widening
I-880	US-101 to San Jose	2	8	Widening
US-101	San Jose to Gilroy	2	6	Widening
US-101	Gilroy to SR-152	2	4	Widening
SR-152	US-101 to I-5	2	2	Widening
SR-152	I-5 to SR-99	2	4	Widening
I-80	San Francisco to I-880	2	10	[b]
I-80	I-880 to I-5 (Sacramento)	2	8	Widening
I-880	I-80 to I-238	2	8	Widening
I-580	I-880 to I-5 (via I-238)	2	8	Widening
I-880	I-238 to Fremont/Newark	2	8	Widening
I-880	Fremont/Newark to US-101	2	6	Widening
Sacramento to Bakersfield				
I-5	I-80 to Stockton	2	6	Widening
I-5	Stockton to I-580/SR-120	2	6	Widening
I-5	I-580/SR-120 to SR-152	2	4	Widening
I-5	SR-152 to SR-99	2	4	Widening
SR-99	I-5 to SR-58	2	6	Widening
SR-99	Sacramento to SR-120	2	4	Widening
SR-99	SR-120 to Modesto	2	6	Widening
SR-99	Modesto to Merced	2	4	Widening
SR-99	Merced to SR-152	2	4	Widening
SR-99	SR-152 to Fresno	2	4	Widening
SR-99	Fresno to Tulare/Visalia	2	6	Widening
SR-99	Tulare/Visalia to SR-58	2	4	Widening
Bakersfield to Los Angeles				
I-5	SR-99 to SR-14	2	6	Widening
I-5	SR-14 to I-405	4	10	Separate facility
I-5	I-405 to Burbank	4	8	Widening
I-5	Burbank to LAUS	4	8	Widening
SR-58/14	SR-99 to Palmdale	0	4	Widening
SR-14	Palmdale to I-5	2	4	Widening

Highway Corridor	Segment (From–To)	No. of Additional Lanes[a] (Total–Both Directions)	No. of Existing Lanes (Total–Both Directions)	Type of Improvement
Los Angeles to San Diego via Inland Empire				
I-10	I-5 to East San Gabriel Valley	2	10	Widening
I-10	East San Gabriel Airport to ONT	2	8	Widening
I-10	ONT to I-15	2	8	Widening
I-10	I-15 to I-215	2	8	Widening
I-15	I-10 to I-215	2	8	Widening
I-215	Riverside to I-15	2	4	Widening
I-215	I-10 to Riverside	2	6	Widening
I-15	I-215 to Temecula	2	10	Widening
I-15	Temecula to Escondido	2	8	Widening
I-15	Escondido to Mira Mesa	2	10	Widening
I-15	Mira Mesa to SR-163	2	10	Widening
SR-163	I-15 to I-8	2	8	Widening
Los Angeles to San Diego via Orange County				
I-5	LAUS to I-10	4	8	Widening
I-5	I-10 to Norwalk	2	6	Widening
I-5	Norwalk to Anaheim	2	6	Widening
I-5	Anaheim to Irvine	2	10	Widening
I-5	Irvine to I-405	2	10	Widening
I-5	I-405 to SR-78	2	8	Widening
I-5	SR-78 to UTC	2	8	Widening
I-5/I-8	UTC to San Diego Airport	2	8	Widening
I-8	SR-163 to I-5	2	8	Widening

[a] Represents the number of through lanes in addition to the total number of lanes in the No Project highway network that would serve the representative demand.

[b] No additional or separate facility assumed. Additional demand is assumed to utilize the existing bridge, spreading the peak period congestion.

2.7.3 High-Speed Train Alternative

The proposed statewide HST system would be capable of speeds in excess of 200 mph (320 kph) on dedicated, fully grade-separated tracks, with state-of-the-art safety, signaling, and automated train control systems. Steel-wheel-on-steel-rail technology would serve the major metropolitan centers of California, extending from Sacramento and the San Francisco Bay Area through the Central Valley, to Los Angeles and San Diego (Figure 2.7-3).

Forecasted ridership for this system varies between 42 and 68 million passengers (up to 10 million riders are long-distance commuters) for 2020, depending on the assumptions made in the ridership forecast modeling, with a potential for higher ridership beyond 2020. Sensitivity analyses using assumptions of increased costs and congestion of air and automobile travel resulted in the high end of the range of potential ridership. For a conservative assessment of potential impacts, this higher forecast is used as a basis for defining the HST Alternative and is referred to elsewhere in this report as the *representative* *demand*. The highest return on investment route identified in the Business Plan serves to represent the proposed HST Alternative for general comparison and evaluation with the other system alternatives.

Throughout each region of the state, many alignment and station options have been identified and selected for analysis in the Program EIR/EIS through a comprehensive screening evaluation. These options are evaluated in the Program EIR/EIS, and key differences are addressed in the comparison of system alternatives. Within the alignment and station options are several major design options including the following.

- Northern Mountain Crossing: Mountain crossing options through the Coastal Mountain Range between the Central Valley and the Bay Area. Primarily two options: the Pacheco Pass through Gilroy and a northern crossing more directly aligned with San Jose.
- Southern Mountain Crossing: Mountain crossing options through the Tehachapi Mountain Range between Los Angeles and Bakersfield. Primarily two options: the I-5 corridor and a route through the Antelope Valley.
- Bay Area: Service options to the Bay Area along the peninsula to San Francisco and/or the East Bay to Oakland.
- Southern California: Service to Orange County in addition to service to San Diego via Inland Empire and the I-15 corridor.
- Shared-Use Options: Service to the urban centers on shared tracks with other passenger rail services. Based on the screening evaluation, the state-of-the-art high-speed steel-wheel-on-steel-rail technology considered for the system must also be capable of sharing tracks with other services at reduced speeds in heavily urbanized areas (i.e., San Jose to San Francisco, and Los Angeles to Orange County).
- Link to LAX: Direct or transfer to other transit system.

Conceptual designs were developed for all of the alignment options that include horizontal alignment, profile, and general infrastructure cross-sections. Conceptual designs and design criteria for the passenger stations and other support facilities are presented in *Engineering Criteria*, January 2004Maps illustrating the horizontal alignment and profile type (aerial, at grade, and tunnel) and cross-section schematics are provided in the technical report *Alignment Configuration and Cross Sections*, published by the Authority in January 2003. The relation of each of the alignment options to other existing transportation facilities is also a key aspect of the conceptual designs. This information defines the general physical characteristics of the options for consideration in the environmental technical analyses presented in this Program EIR/EIS. Figures 2.7-4 through 2.7-13 illustrate the alignment characteristics (relation to existing corridors and proposed configurations) for alignment options in each region.